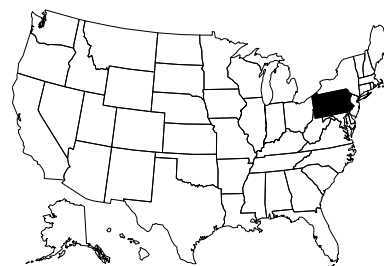


# PENNSYLVANIA

## Contact Information

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PA DEP Office of Water Management homepage:  
<http://www.dep.state.pa.us/dep/deputate/watermgt/watermgt.htm>



## Program Description

The basics of Pennsylvania's current water quality monitoring program began in the late 1960s and has included elements of bioassessment in some form since its inception. The primary objectives of the water quality monitoring program are to define surface water quality status and trends and to evaluate compliance with discharge permit limits.

The State of Pennsylvania uses biological assessments in several program areas. The Statewide Surface Water Assessment Program (SSWAP), started in 1997, was developed to assess all 83,000 miles of streams in the state. The first comprehensive statewide assessment is scheduled for completion by 2007. After five seasons, approximately two thirds of Pennsylvania's surface waters have been assessed. Assessments are based on an evaluation of the instream habitat and macroinvertebrate community composition. All assessed streams are determined to be either impaired or unimpaired and a source and cause is listed for the former. These data are compiled into an MS Access database and GIS stream layer that is updated yearly and submitted to USEPA as part of the 305(b) report. Impaired reaches are placed on the 303(d) list and scheduled for follow-up TMDLs. Due to increasing complexities in the TMDL program, the assessment field methodology will be refined and enhanced in order to satisfy data needs for TMDL development.

Pennsylvania's Antidegradation Program also uses biological assessments based on a modified version of USEPA's Rapid Bioassessment Protocols (RBP) methodology to define aquatic life use designations of candidate streams. Biological samples are collected, subsampled, identified, and selected metrics are generated and analyzed. Candidate streams are compared to reference streams to determine if they qualify for designation as High Quality or Exceptional Value Waters. To alleviate the problem of site-specific reference site variability, staff biologists are currently working to develop a set of regionalized Reference Condition scores that can be compared to candidate streams.

Biological assessments are also an important component of the Surface Water Quality Monitoring Network (WQN). Biological samples are collected at 26 fixed stations three times per year (spring, summer, and fall) and once a year (summer) at 123 additional stations using the same RBP methodology referenced above. These data, in conjunction with bimonthly water chemistry samples, are used to monitor long-term trends in water quality on the major streams in the Commonwealth.

Fish are collected at approximately 35 WQN stations each year. Fillets from these fish are analyzed for contaminants such as heavy metals and pesticides. This tissue analysis is used to generate consumption advisories for fish living in any contaminated surface waters.

In order to more effectively meet its water quality objectives, Pennsylvania has fostered several cooperative bioassessment partnerships. Through contracts with the PA DEP, the Pennsylvania Fish and Boat Commission (PFBC), Susquehanna River Basin Commission (SRBC), and Interstate Commission on the Potomac River Basin (ICPRB) assist with SSWAP assessments. The Department plans to contract with the USGS to collect WQN samples. There are also cooperative efforts with citizen monitoring groups for water quality monitoring data collection and 305(b) reporting purposes.

While Pennsylvania's bioassessment efforts have increased in recent years (Statewide Surface Waters Assessment program), additional bioassessment challenges are being tackled. Department biologists are currently working to develop fish-based bioassessment methodologies for larger streams, refine lake assessments for 303(d) reporting purposes, and bioassessments of specialized habitats; such as limestone, glide/pool dominated, and non-wadeable waters.

## Documentation and Further Information

*Commonwealth of Pennsylvania 2000 Water Quality Assessment 305(b) Report:*  
[http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305\\_wq2000\\_narr.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305_wq2000_narr.htm)

*Commonwealth of Pennsylvania 2001 305(b) UPDATE:*  
[http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305\\_wq2001\\_narr.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305_wq2001_narr.htm)

*DRAFT 2002 Section 303(d) Report, List of Impaired Waterbodies, June 2002:*  
<http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/303d-Report.htm>

*Pennsylvania's Surface Water Quality Monitoring Network (WQN), revised 2001:*  
<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/Facts/BK0636-1.pdf>

*Water Quality Assessment and Standards Fact Sheets:*  
<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/Facts/Pubs-c.htm>

# PENNSYLVANIA

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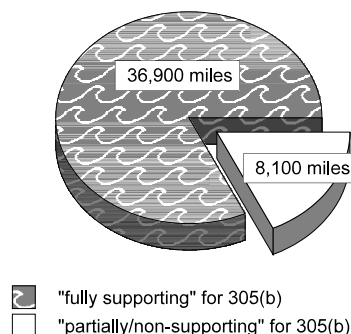
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin ( <i>special projects only</i> )
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>83,000</b>
<i>(determined using 1/24,000 scale streams GIS coverage)</i>	
Total perennial miles	—
<b>Total miles assessed for biology</b>	<b>45,000</b>
fully supporting for 305(b)	36,900
partially/non-supporting for 305(b)	8,100
listed for 303(d)	8,100
number of sites sampled	7,435
number of miles assessed per site*	—

## 45,000 Miles Assessed for Biology



\*Stations are placed at the mouths of major tributaries and on mainstems; towns are bracketed (upstream/downstream) depending on landuse observed while in field.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Fishery Based Uses	
<b>ALU designations in state water quality standards</b>	Four designations: Cold water fishes, Warm water fishes, Migratory fishes, Trout stocking	
<b>Narrative Biocriteria in WQS</b>	none - Antidegradation protocols used to support general aquatic life standard are under development, not statutory - found in Chapter 93 of Statutory Code.	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	none	

## Reference Site/Condition Development

<b>Number of reference sites</b>	~100 total	
<b>Reference site determinations</b>	<input type="checkbox"/>	site-specific
	<input checked="" type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Based on stream classification in the antidegradation program, land use, and habitat: primarily forested, no water quality criteria violations, excellent habitat, and minimal siltation.	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: minimally disturbed
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input checked="" type="checkbox"/>	other: drainage area, land use, use designations, gradient, size and other regionalization other than ecoregion
<b>Additional information</b>	<input checked="" type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>100-500 samples/year; multiple seasons, multiple sites - broad coverage for watershed level</i> )
	<input checked="" type="checkbox"/>	fish* ( <i>&lt;100 samples/year; single season, multiple sites - not at watershed level</i> )
	<input type="checkbox"/>	periphyton
	<input checked="" type="checkbox"/>	other: phytoplankton ( <i>&lt;100 samples/year; single season, multiple sites - not at watershed level</i> )
<b>Benthos</b>		
sampling gear		multiplate, D-frame and kick net (1 meter); >800 micron mesh
habitat selection		riffle/run (cobble)
subsample size		100 count
taxonomy		genus
<b>Fish*</b>		
sampling gear		backpack and boat electrofishers
habitat selection		multihabitat
sample processing		length measurement and anomalies
subsample		none
taxonomy		species
<b>Habitat assessments</b>		visual based; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic proficiency checks, specimen archival

\*Pennsylvania Fish & Boat Commission provides fish data to PA DEP. For more information, contact Rick Spear, PA Fish & Boat Commission, 450 Robinson Lane, Bellefonte, PA 16823, Phone: 814/359-5233, e-mail: [rspear@state.pa.us](mailto:rspear@state.pa.us).

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>return single metrics - use endpoint for each single metric</i> )
	<input checked="" type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		Still in the process of evaluating the best approach (considering 75 <sup>th</sup> and 95 <sup>th</sup> percentile of reference population and cumulative distribution function)
defining impairment in a multimetric index		Still in the process of evaluating the best approach (considering 75 <sup>th</sup> and 95 <sup>th</sup> percentile of reference population and cumulative distribution function)
<b>Multivariate thresholds</b>		
defining impairment in a multivariate index		In the process of evaluating the best approach
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>two or three separate samples in the same riffle</i> )
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		MS Access
Retrieval and analysis		SAS



# RHODE ISLAND

## Contact Information

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RIDEM Office of Water Resources homepage:  
<http://www.state.ri.us/dem/programs/benviron/water/index.htm>



## Program Description

The importance of biological assessments in the evaluation of water quality has long been recognized in Rhode Island. Biological assessments are used to supplement physical and chemical water quality monitoring data. More specifically, the biological data can be used to identify long-term trends in water quality which reflect water pollution abatement efforts and/or needs. The Rhode Island Department of Environmental Management (RIDEM), Office of Water Resources (OWR) has two types of biological monitoring programs. Multiple plate artificial substrates have been used to evaluate the biological community in deep rivers since 1974. In addition, EPA's Rapid Bioassessment Protocol (RBP) (USEPA 1989) has been used since 1991 for the assessment of the biological integrity of various shallow river sites in the state.

### Artificial Substrate Monitoring

The Fullner multiple-plate artificial substrate with 14 plates has been used by the Office of Water Resources for over 20 years to assess instream biological communities. Stations selected for this biological monitoring include those used for USGS trend chemical sampling to more closely relate chemical and biological data. This method has the advantage of providing a uniform sampling habitat for each station, thus reducing the problem caused by varying types of river bottom and depth. Macroinvertebrates collected on the artificial substrates are classified according to their tolerance of pollutants.

### Rapid Bioassessment Protocol Monitoring

RBP monitoring involves an integrated assessment, comparing habitat (physical structure, flow regime) and biological measures with defined reference site conditions. Since 1992, a network of 45 stream riffle-area sites have been surveyed by Roger Williams University in cooperation with and contracted by RIDEM. Each site is visited during the spring-summer season and macroinvertebrates are sampled (minimum 100 organisms per site visit where feasible). Data are analyzed using RBP I and II protocols, which include varying degrees of field and laboratory organism identification.

The streams sampled within the state range from first order to fifth order. Eight of the streams are considered to be first order, eighteen second order, twelve third order, four fourth order and three are of the fifth order. Lower order streams are quite dependent upon the immediate characteristics of the watershed. In other words, runoff is a direct-affect component versus one of many components within a higher order stream. It is important to note that the 1993, 1995 and 1997 sampling events took place during drought conditions, which may have resulted in fewer riffles, lower dilution and lack of runoff. This probably affected the types of organisms collected and resulted in an altered picture of the stations based from that seen in other years. This information was taken into account during the evaluation of the biological assessments.

Initial bioassessment work involved establishing and field testing the RBPs in Rhode Island streams and rivers. In addition, refinement of the protocol over the past 4 years has established the presence of two sub-ecoregions within the state: coastal areas and inland areas. Incorporation of the presence of these two sub-ecoregions into selection of reference sites and application of the protocols will continue. The habitat/physical parameters and biological metrics of each station were compared to those of the selected reference station and given an overall bioassessment score.

## Documentation and Further Information

*The State of the State's Waters Rhode Island Section 305(b) Report*, September 2000:  
<http://www.state.ri.us/dem/pubs/305b/index.htm>

*State of Rhode Island 2000 303(d) List of Impaired Waters*, November 2000: <http://www.state.ri.us/dem/pubs/303d/303d00.pdf>

*Water Quality Regulations* (including WQS), amended June 2000:  
<http://www.state.ri.us/dem/pubs/regs/REGS/WATER/h20qlty.pdf>

# RHODE ISLAND

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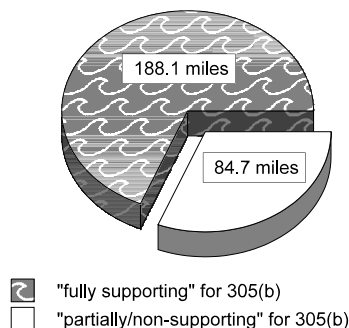
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>1,498</b>
<i>(determined using state based GIS coverage)</i>	
Total perennial miles	979
<b>Total miles assessed for biology*</b>	<b>272.8</b>
fully supporting for 305(b)*	188.1
partially/non-supporting for 305(b)*	84.7
listed for 303(d)*	78.5
number of sites sampled ( <i>on an annual basis</i> )**	~62
number of miles assessed per site	site specific

## 272.8 Miles Assessed for Biology



\*These numbers represent the miles assessed for ALUS using biology or a combination of biological and chemical data. The miles listed for 303(d) were taken from the RI draft 2002 303(d) list for biodiversity impairments.

\*\*Roughly 62 sites are monitored on an annual basis, though this number does vary (10 = artificial substrate; 45 - 50 = RBP). Fifty-five additional sites were sampled in 2000 as part of a random sampling design for the EPA.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Single Aquatic Life Use and Class System (A,B,C)	
<b>ALU designations in state water quality standards</b>	One designation: fish and wildlife habitat	
<b>Narrative Biocriteria in WQS</b>	No formal/informal numeric procedures are used to support narrative biocriteria; however, there is a qualitative and/or narrative scale of condition.	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Super-fund sites and Rhode Island Pollutant Elimination Discharge System (RIPDES) permit toxic elimination	

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>2 total</b>	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Minimally impaired/disturbed (best reference site in New England) – natural conditions, bank erosion, land use, etc. High Quality unimpaired condition for RBP or site-specific for special site studies.	
<b>Characterization of reference sites within a regional context</b>	<input checked="" type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: minimally disturbed*
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input checked="" type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input type="checkbox"/>	some reference sites represent acceptable human-induced conditions

\*Rhode Island's reference sites are considered minimally disturbed. The Wood River reference site (most widely used) will likely remain minimally disturbed because its watershed is largely contained within State Park boundaries. RI allows for about a 20% variation from that target for compliance. However, special watershed projects may be asking an upstream or downstream question and, therefore, may be required to find a least disturbed site within the unique segment for comparison.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>&lt;100 samples/year; single season, multiple sites - broad coverage</i> )
	<input checked="" type="checkbox"/>	fish ( <i>sampled once in conjunction with USEPA: &lt; 100 samples; single observation</i> )
	<input type="checkbox"/>	periphyton
	<input checked="" type="checkbox"/>	other: macrophytes ( <i>&lt;100 samples/year; single season, multiple sites - broad coverage</i> )
<hr/>		
<b>Benthos</b>		
sampling gear		collect by hand, multiplate, D-frame; 200-400 micron mesh
habitat selection		riffle/run (cobble), artificial substrate
subsample size		100 count
taxonomy		combination
<hr/>		
<b>Habitat assessments</b>		visual based; performed with bioassessments
<hr/>		
<b>Quality assurance program elements</b>		standard operating procedures, periodic meetings and training for biologists, taxonomic proficiency checks, and specimen archival

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<hr/>		
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		25 <sup>th</sup> percentile of reference population
defining impairment in a multimetric index		75 <sup>th</sup> percentile of reference population - standard random sampling design, EPT index, RBPs
<hr/>		
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input checked="" type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<hr/>		
<b>Biological data</b>		
Storage		databases, spreadsheets
Retrieval and analysis		EDAS

# SOUTH CAROLINA

## Contact Information

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SC DHEC Bureau of Water homepage: <http://www.scdhec.net/water/>



## Program Description

Biologists at the South Carolina Department of Health and Environmental Control use aquatic macroinvertebrates as bioindicators to make assessments of water quality. The program began in the early 1970s with the first technical report printed in 1972. Currently, flowing streams and rivers are the primary waterbodies that are assessed. South Carolina's monitoring efforts can be divided into two categories: ambient monitoring and special studies. Both fixed sites and randomly selected sites are chosen each year for the ambient monitoring work. Fixed sites are sampled once every five years on a rotating basin schedule. Special studies usually involve a point source discharge or a nonpoint source perturbation such as a logging operation. Upstream and downstream sites are selected for sampling when conducting special studies. Agency staff may carry out the special studies or they may be required by the industry as part of a permit or consent order. In the latter case, state certified consultants conduct the studies with the resulting reports reviewed by agency scientists.

South Carolina's program is modeled after that of North Carolina's, which was developed in the 1970s and 1980s. A timed qualitative multihabitat approach is taken for sampling macroinvertebrates. Organisms are picked in the field and returned to the laboratory for identification to the lowest practical taxonomic level – usually genus or species. Two metrics are calculated to produce an assessment: the EPT Index, and the NC Biotic Index. These two metrics are standardized on a scale of 1 to 5 and averaged to produce a final score. The Bioclassification of the stream is based on this score. The numeric criteria developed in SC are dependant on the ecoregion within which the stream is located. There are separate criteria for the mountains, piedmont, and coastal plain regions of the state. For special studies, impact is determined by the change in the bioclassification score from the upstream control site to the downstream test site. A rigorous quality control/quality assurance program has been developed and implemented for sampling, identification of organisms, and data entry.

## Documentation and Further Information

*The 2002 Section 305(b) Water Quality Assessment Report for South Carolina*, March 2000:

<http://www.scdhec.net/eqc/water/pubs/305b.pdf>

*State of South Carolina 303(d) List for 2000*, EPA approved in May 2000:

<http://www.scdhec.net/eqc/water/pubs/303d2000.pdf> (for the DRAFT 2002 303(d) List and 1998 303(d) List, go to <http://www.scdhec.net/eqc/water/html/tmdl.html#303d> )

*The Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. 2001. SC DHEC.

*State of South Carolina Monitoring Strategy for Calendar Year 2002*, January 2002:

<http://www.scdhec.net/eqc/water/pubs/strategy.pdf>

*Antidegradation Implementation for Water Quality in South Carolina*, July 1998:

<http://www.scdhec.net/eqc/water/pubs/antideg.pdf>

Watershed Water Quality Management Strategy Program Description: <http://www.scdhec.net/water/shed/prog.html>

For a list of and links to additional SC DHEC Bureau of Water water quality publications, go to

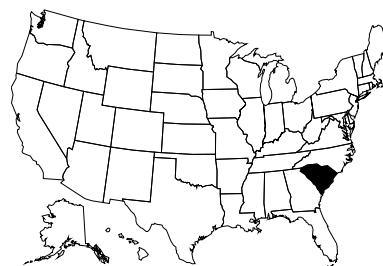
<http://www.scdhec.net/eqc/admin/html/eqcpubs.html#wgreports>

DRAFT July 1998. *Standard Operating Procedures and Quality Control Procedures for Macroinvertebrate Sampling*. Technical Report No. 004-98. Prepared by South Carolina Bureau of Water, Division of Water Monitoring, Assessment and Protection, Aquatic Biology Section.

# SOUTH CAROLINA

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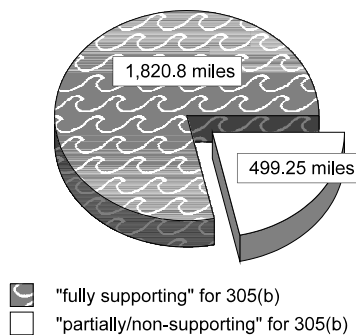
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	probabilistic by stream order/catchment area <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	rotating basin <i>(specific river basins or watersheds)</i>
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b> <i>(determined using RF3)</i>	<b>35,461</b>
Total perennial miles	25,729
<b>Total miles assessed for biology*</b>	<b>2,320</b>
fully supporting for 305(b)	1,820.8
partially/non-supporting for 305(b)	499.25
listed for 303(d)	499.25
number of sites sampled <i>(on an annual basis)</i>	80
number of miles assessed per site	—

## 2,320 Miles Assessed for Biology



\*These miles, listed in the 2000 205(b) report, were assessed based on a combination of physical/chemical **and** biological/habitat data. The following subset of the 2,320 total combined miles contains stream miles assessed based **solely** on biological/habitat: 678.6 total miles assessed, 563.98 miles "fully supporting" for 305(b), and 114.6 miles "partially/non-supporting" for 305(b) and listed for 303(d).

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C) and Warm Water vs. Cold Water
<b>ALU designations in state water quality standards</b>	Three designations: Freshwater, Trout - 3 types, Saltwater
<b>Narrative Biocriteria in WQS</b>	Procedures used to support narrative biocriteria are not included in SC water quality standards, but are available in the monitoring program SOP.
<b>Numeric Biocriteria in WQS</b>	none (South Carolina has limited numeric biocriteria/indices used to evaluate ALU, which are not included in state water quality standards – see monitoring program SOP.)
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input checked="" type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Biocriteria can affect permitting decisions if a watershed is listed on the 303(d) list for biological impacts.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>30 total</b>
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Reference site criteria</b>	The best sites are selected from a habitat and organismal point of view. Faunal characteristics and land use data from GIS are also considered (see newly-amended R.61-68.F.I.d. for more information).
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input checked="" type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input checked="" type="checkbox"/> reference sites linked to ALU <input checked="" type="checkbox"/> reference sites/condition referenced in water quality standards (found in R61-68.F.I.d.) <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (100-500 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<hr/>		
<b>Benthos</b>		
sampling gear		collect by hand, brass sieve, D-frame, kick net (1 meter); 500-600 micron mesh
habitat selection		multihabitat
subsample size		entire sample
taxonomy		combination and species when possible
<hr/>		
<b>Habitat assessments</b>		visual based; performed with bioassessments
<hr/>		
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic and sampling proficiency checks, specimen archival, data entry checks, certification program for bioassessment

## Data Analysis and Interpretation

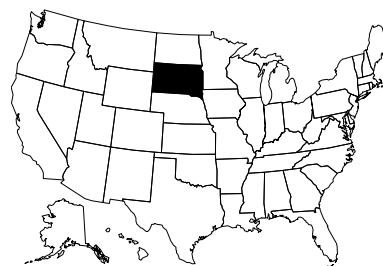
<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<hr/>		
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		cumulative distribution function
defining impairment in a multimetric index		cumulative distribution function - follow guidelines outlined in following document: Lenat. 1993. <i>A biotic index for the southeastern United States, derivation and list of tolerance values, with criteria for assigning water quality ratings</i> . Journal of the North American Benthological Society. 12:279-290
<hr/>		
<b>Evaluation of performance characteristics</b>	<input type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision ( <i>replicate sampling of same stream, 10% each year</i> )
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input checked="" type="checkbox"/>	accuracy ( <i>compare faunal results with land use data and discharge presence or absence</i> )
<hr/>		
<b>Biological data</b>		
Storage		MS FoxPro for Windows and Excel
Retrieval and analysis		FoxPro



# SOUTH DAKOTA

## Contact Information

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SD DENR Surface Water Quality website:  
<http://www.state.sd.us/denr/DES/Surfacewater/surfwpgr.htm>



## Program Description

Currently, the South Dakota Department of Environment and Natural Resources (SD DENR) Water Resources Assistance Program (WRAP) collects biological data in addition to chemical and physical parameters for TMDL assessments. These bioassessments are useful in determining the impact of contaminants as well as detecting chronic water quality impairments that may not be discovered by ambient chemical and physical grab samples. Of the 9,937 total stream miles, approximately 4 miles have been biologically assessed (60 sites assessed; 150 meters per site). SD DENR has not yet established biological criteria for use in water quality standards.

The Water Resource Assistance Program evaluates benthic macroinvertebrate community structure in streams using both the EMAP protocol and USEPA's Rapid Bioassessment Protocols (RBPs) in conjunction with assessments of stream habitats. All biological samples are identified to the lowest possible level of taxonomic resolution. Biological data are entered into the STORET database and are summarized using multimetric indices and descriptive statistics. SD DENR intends to use the biological data to identify potential reference sites for determining the condition of water quality and the integrity of the biological community. WRAP is beginning to sample periphyton communities to determine if they are a better biological indicator of water quality.

## Documentation and Further Information

Stueven, E., A. Wittmuss, and R.L. Smith. 2000. *Standard Operating Procedures for Field Samplers. Revision 4.0, January 2000.* South Dakota Department of Environment and Natural Resources, Water Resource Assistance Program. Pierre, SD.

*Ecoregion Targeting of Impaired Lakes in South Dakota* (May 2000)

*The 2000 South Dakota Report to Congress, 305(b) Water Quality Assessment,*  
[http://www.state.sd.us/denr/Documents/SD\\_2000\\_305b.pdf](http://www.state.sd.us/denr/Documents/SD_2000_305b.pdf)

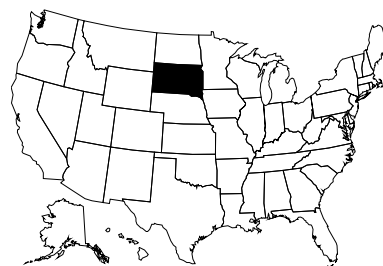
*The 1998 South Dakota 303(d) Waterbody List and Supporting Documentation,*  
[http://www.state.sd.us/denr/303\(d\)/98sd303d.pdf](http://www.state.sd.us/denr/303(d)/98sd303d.pdf)

*South Dakota Surface Water Quality Standards,* <http://legis.state.sd.us/rules/rules/7451.htm>

# SOUTH DAKOTA

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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects, specific river basins or watersheds</i> )
	<input type="checkbox"/>	fixed station (i.e., water quality monitoring stations)
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>9,937</b>
<i>(determined using RF3, National Hydrography Database, and state based determination)</i>	
Total perennial miles	1,932
<b>Total miles assessed for biology*</b>	<b>3.73</b>
fully supporting for 305(b)	n/a
partially/non-supporting for 305(b)	n/a
listed for 303(d)	n/a
number of sites sampled ( <i>on an annual basis</i> )	~60
number of miles assessed per site	~.093
	(150 meters)

\*South Dakota reports only chemical data in 305(b) reports and 303(d) listings. Currently, biological data is only collected during TMDL assessments. South Dakota's DENR plans to use the biological data to locate reference sites and conditions based on ecoregions as well as to establish biocriteria.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Warm Water vs. Cold Water	
<b>ALU designations in state water quality standards</b>	Five designations: Cold Water Permanent, Cold Water Marginal, Warm Water Permanent, Warm Water Semi-Permanent, Warm Water Marginal	
<b>Narrative Biocriteria in WQS</b>	No formal/informal numeric procedures exist to support narrative biocriteria	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input type="checkbox"/>	cause and effect determinations
	<input type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	none	

## Reference Site/Condition Development\*

<b>Number of reference sites</b>	~31 total	
<b>Reference site determinations</b> <i>Under development</i>	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Under development. Criteria used for defining reference sites include: EMAP protocol, habitat, chemical, and aquatic life.	
<b>Characterization of reference sites within a regional context</b> <i>Under development</i>	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b> <i>Under development</i>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
<b>Additional information</b> <i>Under development</i>	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

\*The responses above characterize how reference sites will most likely be determined in the future. Twenty-seven sites have been assessed in South Dakota as reference for the EMAP data set. South Dakota's DENR samples ~4 sites as reference and will be working on establishing formal reference sites and criteria for streams and rivers. Lake reference sites and criteria have already been developed.

## Field and Lab Methods

Assemblages assessed	<input checked="" type="checkbox"/>	benthos (100 - 500 samples/year; single season, multiple sites - not at watershed level)
	<input type="checkbox"/>	fish
	<input checked="" type="checkbox"/>	periphyton (<100 samples/year; single season, multiple sites - not at watershed level)
	<input type="checkbox"/>	other:
Benthos		
sampling gear	D-frame, multiplate, rock baskets; 500 - 600 micron mesh	
habitat selection	multihabitat	
subsample size	300 count	
taxonomy	combination	
Periphyton		
sampling gear	natural substrate: brushing/scraping device (razor, toothbrush, etc.) artificial substrate: microslides or other suitable substratum	
habitat selection	multihabitat	
sample processing	chlorophyll a / phaeophytin, taxonomic identification	
taxonomy	species level	
Habitat assessments		
visual based, quantitative measurements, hydrogeomorphology; performed with bioassessments		
Quality assurance program elements		
standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic proficiency checks, specimen archival		

## Data Analysis and Interpretation

Data analysis tools and methods	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>multimetric index under development</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
Multimetric thresholds		
transforming metrics into unitless scores	25 <sup>th</sup> percentile of reference population, natural breaks	
defining impairment in a multimetric index	25 <sup>th</sup> percentile of reference population	
Evaluation of performance characteristics	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
Not currently evaluated		
Biological data		
Storage	STORET	
Retrieval and analysis	Statistica, EDAS	

# TENNESSEE

## Contact Information

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TDEC Division of Water Pollution Control: <http://www.state.tn.us/environment/wpc/index.html>



## Program Description

The Tennessee Department of Environment and Conservation's (TDEC) Division of Water Pollution Control (WPC), has an extensive bioassessment program. Benthic macroinvertebrate surveys are one of the primary tools used in assessing surface waters in the state. Biological data are instrumental in determining use-support and generating both the 305(b) and 303(d) reports. In-stream macroinvertebrate monitoring is included in many NPDES permits. Bioassessments are also used in the anti-degradation evaluation process. Biological data are used to measure improvements in water quality resulting from clean-up and habitat restoration efforts. Over 2,100 macroinvertebrate surveys have been conducted by TDEC since 1996.

TDEC has eight field offices each with at least two benthic biologist positions. In addition, there is a central laboratory facility in the Department of Health with seven aquatic biologists under contract to TDEC. These nine offices conduct the majority of macroinvertebrate stream surveys. Data from other agencies including the Tennessee Valley Authority (TVA), US Army Corps of Engineers (USACE), and USGS are also incorporated into the program.

In 1995, TDEC initiated an ecoregion delineation project resulting in the identification of 25 ecological subregions. Ninety-eight reference streams were targeted for monitoring. The macroinvertebrate community in these streams was sampled seasonally for three years and on a five-year cycle by watershed starting in 1999. These data were used to develop regional numeric biocriteria that have been proposed for inclusion in the 2002 triennial review of water quality standards. The proposed numeric criteria are already being used to help interpret narrative criteria. In addition, reference stream data were used to develop guidelines for biological reconnaissance as a screening tool during watershed assessments.

Future goals of the bioassessment program include:

- Continue to monitor ecoregional reference streams and locate additional streams to further refine biocriteria and better identify reference condition.
- Conduct additional bioassessments as means to increase TDEC's percentage of assessed streams for national reporting purposes.
- Develop a macroinvertebrate tolerance index specific to Tennessee.
- Develop biocriteria for large rivers, wetlands and reservoirs.
- Continue to use benthic data as a measure of improvement in water quality.

## Documentation and Further Information

Arnwine, D.H. and G. M. Denton. 2001. *Development of Regionally-Based Interpretations of Tennessee's Existing Biological Integrity Criteria*. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN

Arnwine D.H. and G. M. Denton. 2001. *Habitat of Least Impacted Streams in Tennessee*, Tennessee Department of Environment and Conservation, Division of Water Pollution Control, Nashville, TN

Arnwine, D.H., J.I. Broach, L.K. Cartwright and G.M. Denton. 2000. *Tennessee Ecoregion Project*. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

Denton, G.M., A.D. Vann, and S.H. Wang. 2000. *The status of Water Quality in Tennessee: Year 2000 305(b) Report*. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

Griffith, G.E., J.M. Omernik and S. Azevedo. 1997. *Ecoregions of Tennessee*. EPA/600/R-97/022. NHREEL, Western Ecological Division, U.S. Environmental Protection Agency, Corvallis, Oregon.

*Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys*. 2002. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

*DRAFT Year 2002 303(d) List*, July 2002: <http://www.state.tn.us/environment/wpc/2002303ddraft.pdf>

*TDEC General Water Quality Criteria*, rev. October 1999: <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-03.pdf>

*TDEC Use Classifications for Surface Waters*, rev. October 1999: <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-04.pdf>

*2001 Triennial Review of Water Quality Standards, Staff Proposal*: [http://www.state.tn.us/environment/wpc/tr\\_wqs.pdf](http://www.state.tn.us/environment/wpc/tr_wqs.pdf)

Other TDEC publications, including 305(b) reports, can be found online at: <http://www.state.tn.us/environment/wpc/publicat.htm>

# TENNESSEE

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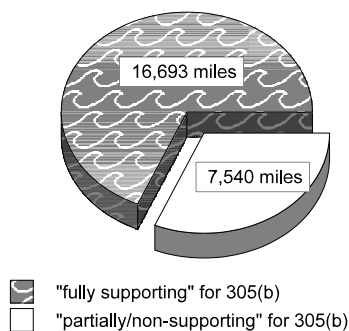
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) <i>(comprehensive use throughout jurisdiction)</i>
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide <i>(special projects only)</i>
	<input checked="" type="checkbox"/>	rotating basin <i>(comprehensive use throughout jurisdiction)</i>
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>60,187</b>
<i>(Determined using RF3)</i>	
Total perennial miles	—
<b>Total miles assessed for biology</b>	<b>24,233</b>
fully supporting for 305(b)	16,693
partially/non-supporting for 305(b)*	7,540
listed for 303(d)*	14,333
number of sites sampled	2,202
number of miles assessed per site	—

## 24,233 Miles Assessed for Biology



\*The stream miles "partially/non-supporting" for 305(b) are significantly less than the stream miles listed for 303(d) because the last 303(d) list was revised in 1998 while the 305(b) reflects assessments through 2000. The 2002 draft 303(d) and 305(b) reports are in agreement.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Single Aquatic Life Use
<b>ALU designations in state water quality standards</b>	One designation: Fish and Aquatic Life
<b>Narrative Biocriteria in WQS</b>	Formal/informal numeric procedures used to support narrative biocriteria are found in the <i>Development of Regionally-Based Numeric Interpretations of Tennessee's Narrative Biological Integrity Criterion</i> (see documentation).
<b>Numeric Biocriteria in WQS</b>	under development (Tennessee water quality standards will be changed in 2002 to reflect proposed numeric criteria for 15 bioregions. Numeric biocriteria, proposed for inclusion in the new WQS are as follows, "Multimetric index using 7 metrics - TR, EPT, %EPT, %OC, NCBI, %DOM and % Clingers*. Scoring criteria is based on 25% of reference condition. Reference condition is based on ecoregion reference data at the 90 <sup>th</sup> percentile. Ecoregions have been grouped into 15 bioregions. Expected index score is calibrated to each bioregion and by season where appropriate.")
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input checked="" type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Nonpoint source section, field offices - office by office use, not systematic/statewide use

\*TR = total richness; EPT = Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies); OC = Orthocladiinae of Chironomidae; NCBI = North Carolina Biotic Index; DOM = dominant taxa.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>98 total</b>
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Reference site criteria</b>	Reference database of chemical, habitat and biometrics based on monitoring of regional reference sites since 1996. Reference sites must fall within 90 <sup>th</sup> percentile for chemical, biological and habitat parameters compared to existing reference database. Disturbed sites are those under 75% comparable to reference condition for biological and habitat, above the 90 <sup>th</sup> percentile (reference) for nutrients (and show impaired biology), or exceed numeric criteria for other specified parameters.
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input checked="" type="checkbox"/> reference sites linked to ALU <input type="checkbox"/> UD reference sites/condition referenced in water quality standards ( <i>WQS under revision</i> ) <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>100-500 samples/year; single season, multiple sites - watershed level</i> )
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		dipnet and kick net (1 meter); 500 - 600 micron mesh
habitat selection		riffle/run used for biocriteria in high gradient streams; rooted bank used for biocriteria in low gradient streams (Note that four jab multihabitat bioreconnaissances are used for general water quality assessments, not comparable to biocriteria)
subsample size		200 count
taxonomy		genus
<b>Habitat assessments</b>		visual based; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		90 <sup>th</sup> or 10 <sup>th</sup> percentile of reference population depending on direction of metric
defining impairment in a multimetric index		25% of 90 <sup>th</sup> (or 10 <sup>th</sup> ) percentile of reference population
<b>Multivariate thresholds</b>		
defining impairment in a multivariate index		Used for development of initial criteria, not for current assessments
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>replicate samples at 10% of reference sites by different teams</i> )
	<input checked="" type="checkbox"/>	precision ( <i>two samples collected at 10% of sites by two teams</i> )
	<input checked="" type="checkbox"/>	sensitivity ( <i>standard level of identification, compare metric scores to known impacts</i> )
	<input checked="" type="checkbox"/>	bias ( <i>compared different sample/habitat types</i> )
	<input checked="" type="checkbox"/>	accuracy ( <i>10% of samples QC for taxonomy and sorting efficiency</i> )
<b>Biological data</b>		
Storage		MS Access; semi-quantitative samples (taxa lists and metric scores) are stored in EDAS database and bioreconnaissance results are stored in Water Quality Database (taxa lists are in paper files). The eventual goal is for data to be sent to STORET. Assessment results are stored in an Assessment Database.
Retrieval and analysis		EDAS, Statview, and multivariate statistical package



# TEXAS

## Contact Information

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## Program Description

Since the late 1980s, biological assessments have been employed for use attainability analyses (UAAs) and the development of an index of biological integrity (IBI) for rivers and streams. A tidal streams IBI is in the preliminary stages of development. Recently, a new emphasis has been placed on bioassessments relative to 303(d) listed waterbodies. For the most part, the new data have not been fully evaluated and work is continuing to expand in this area. Also, for the first time, the draft 2002 Water Quality Inventory includes bioassessments to determine the support of aquatic life uses.

The Texas Parks and Wildlife Department (TPWD) has been a major provider of fish community data for many of the UAAs and the development of the IBI. Other providers include various river authorities in the state.

**\*NOTE: On September 1, 2002, the Texas Natural Resources Conservation Commission (TNRCC) formally changed its name and began doing business as the Texas Commission on Environmental Quality (TCEQ).**

## Documentation and Further Information

*Draft 2002 Texas Water Quality Monitoring and Assessment Report* (Integrated 305(b) report and 303(d) list):  
[http://www.tnrcc.state.tx.us/water/quality/02\\_twqmar/index.html](http://www.tnrcc.state.tx.us/water/quality/02_twqmar/index.html)

*Texas Water Quality Inventory (SFR-050/00)*, includes *Volume I: Surface Water, Groundwater and Finished Drinking Water Assessments and Water Quality Management Programs*:  
[http://www.tnrcc.state.tx.us/admin/topdoc/sfr/050\\_00/050\\_00.html#1](http://www.tnrcc.state.tx.us/admin/topdoc/sfr/050_00/050_00.html#1)

*Revisions to the Texas Surface Water Quality Standards and Implementation Procedures*:  
<http://www.tnrcc.state.tx.us/permitting/waterperm/wqstand/revisions.html>

*Surface Water Quality Monitoring Procedures Manual (Chapter 7: Biological Sampling Procedures and Chapter 8: Stream Habitat Assessment Procedures)*, August 1999, GI-252:  
<http://www.tnrcc.state.tx.us/admin/topdoc/gi/252.html>

*Monitoring and Receiving Water Assessment Procedures Manuals*:  
<http://www.tnrcc.state.tx.us/water/quality/data/wqm/index.html#manuals>

Surface Water Quality Monitoring Program information:  
<http://www.tnrcc.state.tx.us/water/quality/data/wqm/index.html>

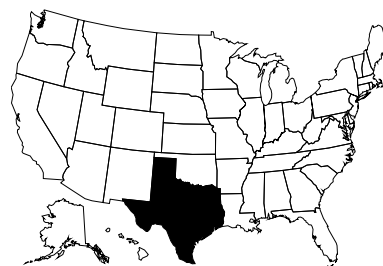
Leppo, E.W., M.T. Barbour, and J. Gerritsen. 2001. *An evaluation of the stream habitat assessment approach used by TNRCC*. Prepared for: Texas Natural Resource and Conservation Commission, Austin, Texas and USEPA Region 6, Dallas, Texas.

# TEXAS

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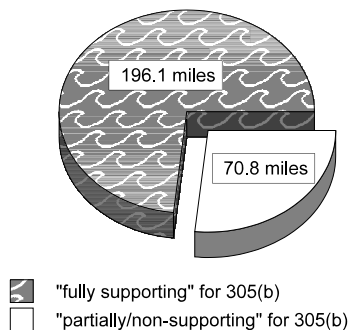
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects, specific river basins or watersheds, and comprehensive use throughout jurisdiction</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide ( <i>special projects only</i> )
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b> (State based determination)	<b>191,228</b>
Total perennial miles	40,194
<b>Total miles assessed for biology*</b>	<b>266.9</b>
fully supporting for 305(b)	196.1
partially/non-supporting for 305(b)	70.8
listed for 303(d)	—
number of sites sampled (on an annual basis)*	30
number of miles assessed per site	—

## 266.9 Miles Assessed for Biology



\*68,611.78 total miles were surveyed and 63,102.68 total miles were assessed. Of these, 266.9 miles were assessed using biology. 30 sites were surveyed and 16 sites were assessed.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)	
<b>ALU designations in state water quality standards</b>	Five designations: Exceptional, High, Intermediate, Limited, and Oyster waters	
<b>Narrative Biocriteria in WQS</b>	Procedures used to support narrative biocriteria located in the <i>Water Quality Standards Implementation Procedures Receiving Water Assessment Procedures Manual</i> (see documentation)	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Trinity River Segment 0805 was elevated from a limited aquatic life use to a high aquatic life use designation. EPA Region 6 considers Texas' high and exceptional aquatic life use designations as meeting the 101(a) goals of the Clean Water Act.	

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>72 total</b>	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input checked="" type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	no point source discharge, land use patterns, limited human impact, least disturbed sites determined using best professional judgment	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input checked="" type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input checked="" type="checkbox"/>	fish (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		surber, multiplate, lopping shears for collecting woody debris, D-frame, kick net; 500-600 micron mesh
habitat selection		riffle/run (cobble), artificial substrate and woody debris
subsample size		100 count and entire sample
taxonomy		combination
<b>Fish</b>		
sampling gear		backpack and boat electrofisher, trawl and gill net (particularly for tidal streams), seine; 1/8", 3/16" and 1/4" mesh
habitat selection		multihabitat
sample processing		length measurement, batch, anomalies
subsample		none
taxonomy		species
<b>Habitat assessments</b>		quantitative measurements; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic proficiency checks, specimen archival

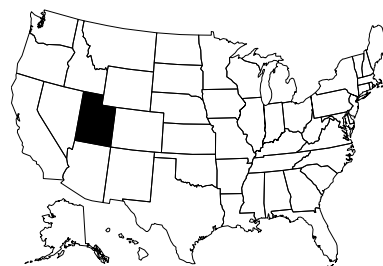
## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		95 <sup>th</sup> percentile of reference population
defining impairment in a multimetric index		50 <sup>th</sup> percentile of reference population (follow EPA RBP guidelines)
<b>Evaluation of performance characteristics</b>  <i>Not currently evaluated</i>	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		TCEQ's TRACS database and hard copies; STORET is under development
Retrieval and analysis		At this time, the hard copies are primarily used for evaluation of biological data. Spreadsheets are also used.

# UTAH

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## Program Description

Prior to 2001, The Utah Division of Water Quality (DWQ) Biological Assessment program was limited to benthic macroinvertebrate data collected at 18 long-term monitoring sites. They have been sampled since 1978 with the exception of about five years in which the allocation of the 18 samples were used to supplement water chemistry and physical data collected in the five-year basin rotation monitoring plan. These samples were collected to ascertain long-term water quality and to be used in determining trends. In addition, benthic macroinvertebrate samples were collected at 16 Nonpoint Source Project sites to assess the effects of BMP implementation. These data have been incorporated into several NPS reports to determine what improvements in water quality have occurred. Data collected from the 18 long-term monitoring sites and the NPS projects have been used in making beneficial use assessments (305(b)) and listing waters on the 303(d) list.

In 2001, the DWQ reviewed its bio-monitoring program and decided that a major effort was needed to improve and develop new components of its water quality assessment program. During this review, an inventory of benthic macroinvertebrate data collected by DWQ, the U.S. Bureau of Land Management (BLM), and the U.S. Forest Service (USFS) was completed. Upon completion of this review, the DWQ contacted the BLM and USFS and requested all of the benthic macroinvertebrate data that they had collected from 1990 through 1997 be sent to DWQ for entering into STORET. These data, along with DWQ's, were entered into STORET. Data collected since 1997 have been stored electronically and a program to electronically transfer these data into STORET is being developed. These data will be evaluated as to their usefulness in establishing reference sites and the development of metrics to be used in assessing beneficial use support.

In 2001, the DWQ negotiated an agreement to complete the E-MAP sampling for EPA within the State. Experience obtained from this work would allow environmental scientists (field and staff) to learn and evaluate the methods used in the E-MAP protocol. This experience could then be used to develop a bioassessment protocol for assessing waters within the State.

Concurrent with doing the E-MAP work, the Division decided to commit additional resources to develop reference sites for bioassessment work. It was decided that the DWQ would select and try to sample up to 60 potential reference sites during the next 2-3 years. Water chemistry, fish, benthic macroinvertebrate, periphyton, and physical habitat data will be collected at these sites. The selection of sites were based upon the different ecoregions within the state and the need for low elevation, low-gradient stream reference sites.

DWQ is also assisting the EPA Corvallis Lab in reviewing and selecting reference sites that were initially selected using GIS techniques. Approximately 100 sites were initially selected and the number has been reduced to 20 sites. The DWQ is assisting in sampling these sites. Information obtained from this program will be evaluated and possibly incorporated into the Division's bio-assessment program.

The DWQ has committed to developing a set of reference sites and metrics that can be used to ensure that the waters of the State are assessed in a scientifically sound and standard method. Work is also going on to evaluate other assessment methods such as RIVPACS in assessing beneficial use support.

## Documentation and Further Information

*Utah Water Quality Assessment Report to Congress, September 2000 and Year 2000 Water Quality Inventory, 305(b) Assessment:* [http://www.waterquality.utah.gov/2000\\_305b\\_fact.pdf](http://www.waterquality.utah.gov/2000_305b_fact.pdf)

*Utah Division of Water Quality's 2000 Water Quality Monitoring Program:*  
[http://www.waterquality.utah.gov/monitoring/complete\\_monitor\\_plan\\_2000.pdf](http://www.waterquality.utah.gov/monitoring/complete_monitor_plan_2000.pdf)

*Utah's 2000 303(d) List of Waters, October 2000:* [http://www.waterquality.utah.gov/documents/approved\\_2000\\_303d.pdf](http://www.waterquality.utah.gov/documents/approved_2000_303d.pdf)

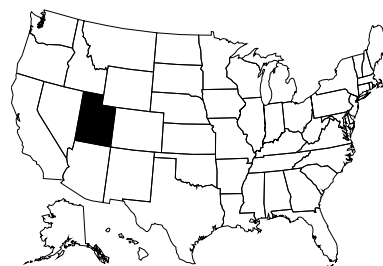
*DRAFT, Utah's 2002 303(d) List of Waters:* <http://www.waterquality.utah.gov/documents/2002303dinternet.pdf>

*Quality Assurance and Standard Operating Procedures Manual.* Utah Department of Environmental Quality, Division of Water Quality. 1993. Utah Department of Environmental Quality, Salt Lake City, UT.

# UTAH

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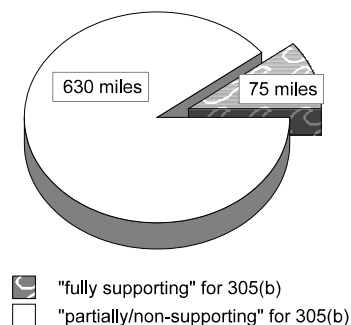
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects, specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>special projects, specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin ( <i>specific river basins or watersheds and comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>85,916</b>
<i>(determined using the National Hydrography database and state based determination)</i>	
Total perennial miles	14,000+
<b>Total miles assessed for biology*</b>	<b>705</b>
fully supporting for 305(b)	75
partially/non-supporting for 305(b)	630
listed for 303(d)	300
number of sites sampled ( <i>on an annual basis</i> )	~56
number of miles assessed per site	12.6

705 Miles Assessed for Biology



\*Biological data were used along with water chemistry data to assess the above listed miles. The biological assessment was done using benthic macroinvertebrates and used a weight-of-evidence assessment because reference sites were not used. Diversity indices, the Biotic Condition Index, and the number of sediment and nutrient tolerant taxa were used to determine beneficial use support when the pollution indicator value for total phosphorus was exceeded.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)
<b>ALU designations in state water quality standards</b>	Five designations*
<b>Narrative Biocriteria in WQS</b>	none - Procedures used to support general aquatic life statement in WQS are not standardized, but are primarily based on best professional judgment using some metrics.
<b>Numeric Biocriteria in WQS</b>	none
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources <input type="checkbox"/> cause and effect determinations <input type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Used primarily in assessing 319 nonpoint source projects including assessment, implementation of BMPs, and evaluation of water quality

\*The designations are as follows: 3A - cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food web. 3B - warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food web. 3C - Nongame fish and other aquatic life including the necessary aquatic organisms in their food chain. 3D - Waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain. 3E - Severely habitat-limited waters.

## Reference Site/Condition Development\*\*

<b>Number of reference sites</b>	not applicable
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input type="checkbox"/> regional (aggregate of sites) <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Reference site criteria</b>	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input type="checkbox"/> reference sites linked to ALU <input type="checkbox"/> reference sites/condition referenced in water quality standards <input type="checkbox"/> some reference sites represent acceptable human-induced conditions

\*\*Utah is currently working with the EMAP to develop reference sites.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	UD periphyton ( <i>A periphyton program is under development and will be used primarily in nutrient-impacted streams. Dr. Sam Rushforth, at Utah Valley State College, is assisting in the development of this program.</i> )
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		rock baskets and Hess; 200-400 micron mesh
habitat selection		riffle/run (cobble) and artificial substrate
subsample size		300 count
taxonomy		combination
<b>Habitat assessments</b>		
		quantitative measurements, and a few nonpoint source project sites have pebble counts, channel profiles and riparian condition evaluated on a very limited basis; performed with bioassessments
<b>Quality assurance program elements</b>		
		standard operating procedures and quality assurance plan

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>return single metrics - use endpoint for each single metric</i> )
	<input type="checkbox"/>	disturbance gradients
	<input checked="" type="checkbox"/>	other: some tolerance information is used in the evaluation
<b>Multimetric thresholds*</b>		
transforming metrics into unitless scores		BCI Methods described by USFS are used to differentiate higher quality waters, less discriminating in impaired waters.
<b>Evaluation of performance* characteristics</b>  <i>Not currently evaluated</i>	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data**</b>		
Storage		Data are currently being loaded into STORET
Retrieval and analysis		SAS (metrics are calculated by the contracting laboratory using spreadsheets or another computer program—language not known)

\*EPA is currently having a contractor review benthic macroinvertebrate data to determine what metrics might apply to various regions of the State. Any metrics presently being used are those produced by the contracting laboratory and best professional judgement is used in the interpretation. No metric sensitivity analyses, regional biases, or other evaluations have been done to this point.

\*\*EPA's Assessment Database is being used to store and retrieve assessment information for Utah's 305(b) report. Some indexing of waterbodies still needs to be done, but this should be completed during fiscal year 2002.



# VERMONT

## Contact Information

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VTDEC Water Quality Division website: <http://www.anr.state.vt.us/dec/waterq/wqhome.htm>



## Program Description

The Water Quality Division of the Vermont Department of Environmental Conservation (VTDEC) has been conducting aquatic biological health assessments since the early 1970's. In 1982, the Biomonitoring and Aquatic Studies Section (BASS) was created with a focus on river and stream biological monitoring. BASS is currently staffed by five full-time aquatic biologists who participate in VTDEC water quality management programs at all levels. This "top to bottom" involvement by biologists has been critical to the extensive acceptance and use of biological assessment data within a wide variety of Departmental programs. The primary objectives of ambient monitoring activities are: 1) monitor long-term trends in water quality as revealed in changes over time to ambient aquatic biological communities; 2) evaluate potential impacts from point and nonpoint permitted direct and indirect discharges, development projects, nonpoint sources, and spills on aquatic biological communities; 3) establish a reference database that would facilitate the generation of Vermont-specific biological criteria for water quality classification and use attainment determinations; 4) support VTDEC permitting and water quality management programs requiring biological assessment data; 5) conduct special studies to assess emerging water quality and environmental management issues. Further information about VTDEC BASS is available at: <http://www.anr.state.vt.us/dec/waterq/bass.htm>.

Since 1985, the Department has used standardized methods for sampling fish and macroinvertebrate communities, evaluating physical habitat, processing samples, and analyzing and evaluating data. The program has led to the development of two Vermont-specific fish community Indexes of Biotic Integrity (IBI) and selected macroinvertebrate metrics. Guidelines have been developed for determining water quality classification attainment by using both macroinvertebrate community biological integrity metrics and the fish community IBI. Approximately 75-125 sites per year are assessed using fish and/or macroinvertebrate assemblages. Alkalinity, pH, conductivity, temperature and such measurements as substrate composition (pebble counts), embeddedness, canopy cover, percent and type of periphyton cover, and approximate velocity are routinely monitored. From 1985 to 2001, approximately 1,500 stream assessments were completed using macroinvertebrate and/or fish from more than 900 wadeable stream reaches. This monitoring effort is subject to a USEPA-approved quality assurance project plan. Data from the project are summarized and stored in an electronic database.

Biological data are used extensively to determine aquatic life use support and impairment. A significant proportion of Vermont's 303(d) list is made up of reaches with impaired aquatic life use determined through bioassessment. The development of biological criteria supported by the Vermont Water Quality Standards has provided a vehicle for enforceable implementation of biocriteria. Biological assessment data are used extensively in virtually all VTDEC water quality management programs, including RCRA, NPDES, CERCLA, watershed planning, 401 certification, aquatic nuisance control permitting, and 305(b). In addition to wadeable stream monitoring, BASS conducts a variety of special studies and assessment in other aquatic habitats, and is in the process of evaluating biocriteria for vernal pools and ponded waters.

VTDEC participates in collaborations with other agencies and organizations including: USEPA; USFWS; USFS; USGS; academic institutions; neighboring states; private consultants; special interest groups; and volunteer monitors. Staff also participate in public outreach activities as resources allow.

Biological criteria are the current performance standards for a large number of 303(d) waterbodies throughout the state. Future demand for biological assessments from VTDEC management programs will increase as the 303(d)/TMDL process advances and watershed planning initiatives expand statewide. The greatest challenge facing the biomonitoring program will be maintaining adequate staff resources to continue assessing 303(d) restoration management actions, providing support to watershed plan development, and providing support to various management programs within VTDEC and the Agency of Natural Resources.

## Documentation and Further Information

*Vermont 2000 Water Quality and Assessment, 305(b) Report*

*Vermont Water Quality Methodology, April 2001*

*Wadeable Stream Biocriteria Development for Fish and Macroinvertebrate Assemblages in Vermont Streams and Rivers*

*July 2, 2000 Vermont Water Quality Standards:* <http://www.state.vt.us/wtrboard/july2000wqs.htm>

*Fish Sampling and Metrics homepage:* <http://www.anr.state.vt.us/dec/waterq/bassfish.htm>

*Macroinvertebrate Sampling, Processing and Metrics homepage:* <http://www.anr.state.vt.us/dec/waterq/bassmacro.htm>

# VERMONT

## Contact Information

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## Programmatic Elements

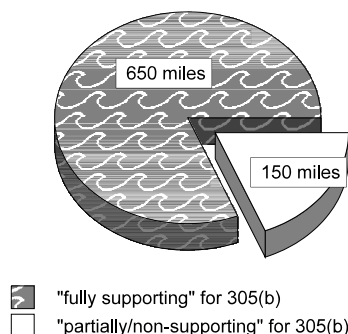
<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input checked="" type="checkbox"/>	other: bioassessments used for all aquatic life use support evaluations
<b>Applicable monitoring designs*</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	probabilistic by stream order/catchment area <i>(special projects only)</i>
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin <i>(specific river basins or watersheds)</i>
	<input type="checkbox"/>	other:

\*The majority of biological sampling conducted by VTDEC is targeted and in the context of rotating basin elements. Fixed station and special projects are also significant elements. Some monitoring required by discharge permits or basin plans related to TMDL's is done by consultants. Consultants generating biological monitoring data for aquatic life use support determinations consistent with Vermont Water Quality Standards or for compliance with discharge permit limitations are required to meet QA/QC requirements and submit to QA oversight by VTDEC biologists.

## Stream Miles

<b>Total miles</b> <i>(State based determination)</i>	<b>7,099</b>
Total perennial miles	7,099
<b>Total miles assessed for biology*</b>	<b>~800</b>
fully supporting for 305(b)	~650
partially/non-supporting for 305(b)	~150
listed for 303(d)	~150
number of sites sampled <i>(total number with available biological monitoring data)</i>	1,193
number of miles assessed per site	—

## 800 Miles Assessed for Biology



\*The latest 305(b) report was used to estimate some of these numbers. 305(b) reports total stream miles assessed by "evaluation" and "monitoring". The majority of VTDEC sites that are "monitored" are monitored for biology. The total miles reported as assessed in the last "statewide" assessment report in 2000 was 5,261, with 4,411 miles "evaluated" and 850 miles "monitored". Roughly 800 of the 850 miles "monitored" were monitored using biology (similarly with use support categories).

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)	
<b>ALU designations in state water quality standards</b>	Three designations related to changes from reference condition: minimal, minor, and moderate change from the reference condition.	
<b>Narrative Biocriteria in WQS</b>	VTDEC procedures used to support narrative biocriteria are independent of WQS.	
<b>Numeric Biocriteria in WQS</b>	none (Numeric biocriteria are currently found in VTDEC procedural documents.)	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Used extensively throughout management programs including: NPDES, 305(b), 303(d), basin planning, point and nonpoint source management, aquatic nuisance control, RCRA, CERCLA.	

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>150 total</b>	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Reference sites are defined using the best professional judgment of biologists based on the level of human activity and potential for that activity to affect the aquatic resource. There are no quantitative criteria, but general considerations may include: very good riparian condition at site; predominantly forested watershed; outside the influence of assessed activity; least disturbed condition.	
<b>Characterization of reference sites within a regional context</b>	<input checked="" type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input checked="" type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: minimally disturbed*
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input checked="" type="checkbox"/>	stream type
	<input checked="" type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
<b>Additional information</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	reference sites linked to ALU
	<input checked="" type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input type="checkbox"/>	some reference sites represent acceptable human-induced conditions

\*This language is included in the definition of reference condition in the Vermont Water Quality Standards, effective July 2, 2000.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (100-500 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	fish (<100 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	periphyton ( <i>Periphyton and algae in rivers and streams are sampled qualitatively for descriptive purposes only. Some indirect discharge permits require quantitative periphyton and macroinvertebrate sampling with artificial substrates in order to determine compliance with permit conditions. Compliance criteria are independent of WQS.</i> )
<b>Benthos</b>		
sampling gear		rock baskets, kick net (18x9 rectangular net, 500 micron mesh)
habitat selection		riffle/run (cobble) and woody debris (varies according to stream category)
subsample size		must be minimum 300 animals AND 25% of sample.
taxonomy		lowest possible taxon - genus, species and combination (specified level in SOPs and C185)
<b>Fish</b>		
sampling gear		backpack electrofisher
habitat selection		multihabitat
sample processing		length measurement and anomalies
subsample		none
taxonomy		species
<b>Habitat assessments</b>		visual based and hydrogeomorphology - performed with and independent of bioassessments; pebble counts currently implemented quite extensively in conjunction with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures; quality assurance plan; periodic meetings and training for biologists; sorting and taxonomic proficiency checks; specimen archival; sending voucher specimens to experts for identification confirmation

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index and return single metrics - use endpoint for each single metric</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds*</b>		
transforming metrics into unitless scores		Combination of reference distribution, impaired site distribution, and best professional judgement; do not use unitless scores.
defining impairment in a multimetric index		Cumulative distribution function
<b>Multivariate thresholds*</b>		
defining impairment in a multivariate index		Significant departure from mean of reference population
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>long term fixed station sampling</i> )
	<input checked="" type="checkbox"/>	precision ( <i>field replication</i> )
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input checked="" type="checkbox"/>	accuracy ( <i>sample processing and analysis QA</i> )
<b>Biological data</b>		
Storage		Data are stored and managed in MS Access data base. Various programs used to analyze sub-sets include: Excel, Sigma-Plot/Stat and PC-ORD
Retrieval and analysis		MS Access database calculates metrics and generates event summary reports. Data can be moved from Access to other programs for project-specific analyses. Commonly used programs include: Excel, Sigma-Plot/Stat, PC-ORD

\*Benthos data are used to generate individual metrics, which are considered individually. Fish assemblage data are used to generate metrics for a multimetric Index of Biotic Integrity. Water Quality Standard thresholds (deviations from the reference condition) are based on BPJ evaluations of metric distribution patterns in both reference and non-reference sites.

# VIRGINIA

## Contact Information

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DEQ Water Programs homepage: <http://www.deq.state.va.us/water/>



## Program Description

The Virginia Department of Environmental Quality (DEQ) Biological Monitoring Program (BMP) utilizes the study of bottom dwelling macroinvertebrate communities to determine overall water quality. Changes in water quality generally alter the kinds and numbers of these animals living in streams or other waterbodies. Like physical and chemical water quality monitoring data, biological monitoring data are used to assess water quality for support of aquatic life designated use and the Clean Water Act "fishable and swimmable" goals.

The BMP is composed of 150 to 170 stations that are examined annually during the spring and fall. Qualitative and semiquantitative biological monitoring has been conducted by the agency since the early 1970s. The USEPA Rapid Bioassessment Protocol (RBP) II was employed beginning in the fall of 1990 to utilize standardized and repeatable methodology. The RBPs produce water quality ratings of nonimpaired, slightly impaired, moderately impaired and severely impaired instead of the former ratings of good, fair and poor.

Currently, there are approximately 70 organizations throughout the Commonwealth with active citizen water quality monitoring programs. Biological parameters measured by citizen monitors often include benthic macroinvertebrates, fecal coliform bacteria, and/or chlorophyll *a*. A statewide organization, the Izaak Walton League of America Virginia Save Our Streams Program (IWLA VA SOS), took the lead in establishing relations with DEQ and the Department of Conservation and Recreation (DCR) to develop a statewide citizen monitoring program. IWLA VA SOS has a benthic macroinvertebrate citizen monitoring protocol that is widely used by many affiliate organizations. In 2000, VA SOS completed a two-year study, funded by DEQ, evaluating this protocol and developing a new protocol to more closely correlate with professional methods developed by EPA and used by DEQ.

## Documentation and Further Information

*Water Quality Assessment and Impaired Waters Report* (combined 2002 305b and 303d), July 2002:  
<http://www.deq.state.va.us/water/305b.html>

*2000 Water Quality Assessment 305(b) Report*: <http://www.deq.state.va.us/water/00-305b.html>

*Water Quality Assessment Guidance Manual* for 2002, 305(b) and 303(d) reports, July 2002:  
<http://www.deq.state.va.us/pdf/water/wqassessguide.pdf>

*2001 Ambient Water Quality Monitoring Plan*:  
<http://www.deq.state.va.us/water/my01rpt.html>

*Watershed Maps of Virginia Impaired Water Segments, 303(d) TMDL Priority List*:  
<http://www.deq.state.va.us/watermaps/>

# VIRGINIA

## Contact Information

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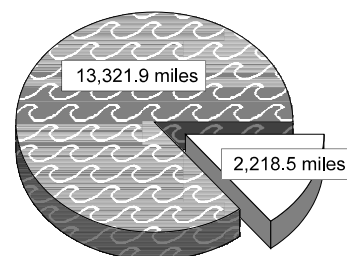
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>50,329</b>
<i>(determined using the National Hydrography Database)</i>	
Total perennial miles	50,329
<b>Total miles assessed for biology*</b>	<b>15,540.4</b>
fully supporting for 305(b)*	13,321.9
partially/non-supporting for 305(b)*	2,218.5
listed for 303(d)*	2,218.5
number of sites sampled ( <i>on an annual basis</i> )*	150 -170
number of miles assessed per site	—

15,540.4 Miles Assessed for Biology



☒ "fully supporting" for 305(b)  
☐ "partially/non-supporting" for 305(b)

\*The numbers listed above were extracted from Virginia's 2002 combined 305(b)/303(d) report and represent stream and river miles assessed (evaluated and monitored) for aquatic life using chemical, physical and biological parameters. However, of the 2,218.5 total miles partially/non-supporting for 305(b), 661.4 miles were determined to be impaired based solely on biological (benthic) data.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Single Aquatic Life Use	
<b>ALU designations in state water quality standards</b>	Three designations (apply to all State waters): recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; and the production of marketable resources, e.g. fish and shellfish.	
<b>Narrative Biocriteria in WQS</b>	none - Virginia has no formal/informal numeric procedures to support general aquatic life statement found in WQS	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input type="checkbox"/>	assessment of aquatic resources
	<input type="checkbox"/>	cause and effect determinations
	<input type="checkbox"/>	permitted discharges
	<input type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input type="checkbox"/>	watershed based management
<i>Information not provided</i>		
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Several TMDLs are addressing ALUS restoration because of poor bioassessment scores.	

## Reference Site/Condition Development

<b>Number of reference sites</b>	information not provided	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input checked="" type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	No reference site criteria. Reference sites are defined as best available, least impaired.	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (300-400 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		D-frame, kick net (1 meter); 500-600 micron mesh
habitat selection		richest habitat and riffle/run (cobble)
subsample size		100 count
taxonomy		family
<b>Habitat assessments</b>		visual based; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, specimen archival

## Data Analysis and Interpretation

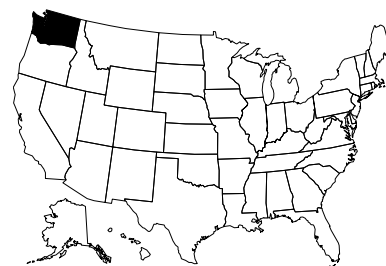
<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input type="checkbox"/>	biological metrics
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Evaluation of performance characteristics</b>		repeat sampling
<i>Information not provided</i>	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		EDAS
Retrieval and analysis		EDAS



# WASHINGTON

## Contact Information

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email: [rplo461@ecy.wa.gov](mailto:rplo461@ecy.wa.gov)  
Stream Biological Monitoring website:  
[http://www.ecy.wa.gov/programs/eap/fw\\_benth/fw\\_b intr.html](http://www.ecy.wa.gov/programs/eap/fw_benth/fw_b intr.html)



## Program Description

Washington State's Biological Monitoring Program has been operated by the Washington Department of Ecology since 1993. The program has served as a focal point for technical assistance and as a reference for data comparison. Its primary objectives are: 1) to continually describe the spatial and temporal features of biotic communities in wadeable streams, 2) describe and then validate biological expectations for appropriate spatial classifications (e.g., ecoregions), 3) develop guidance and criteria that evaluate human-induced disturbance in biological communities, and 4) expand where biological information is used in water quality and resource management. Although field data collection methodology has remained consistent, data storage and analytical products have improved in their capacity and sophistication.

The Freshwater Monitoring Unit within the Department of Ecology has engaged in biological monitoring activities for more than twelve years and has made its information available online for public use. The primary objectives in continuing to develop this program are to: 1) proceed with calibration of ten biometrics that will be based on reference conditions within each of eight ecoregions, 2) continue assistance in development of RIVPACS (River Invertebrate Prediction and Classification System) models for western and eastern Washington streams with researchers at Utah State University (Dr. C. Hawkins), and 3) locate and visit additional reference sites outside of the ranges currently being monitored.

Interpretive tools developed from these efforts are being placed into the ALUS framework under development by the USEPA (contact Susan Jackson). WA is able to use the knowledge and tools developed through former biological monitoring efforts to create a meaningful matrix of expectations as diagrammed by ALUS so that incremental improvements in stream quality, based on biological signatures, can be tracked. The first step toward adoption of biocriteria will be the construction of a guidance that outlines analytical products and biological expectations for streams within each ecoregion of Washington State. Biological evaluation tools such as RIVPACS scores, biometric scores, index scores, and indicator taxa are currently being assembled for inclusion in the guidance.

Biological information is currently being included in the 303(d) listing process to directly evaluate impairment. WA has amassed an adequate data bank for describing reference conditions that serves as an effective and defensible means for comparison. The Freshwater Monitoring Unit issued a report titled "Condition of Freshwaters in Washington State for the Year 2000" that evaluates data from water quality monitoring, biological monitoring, lakes monitoring, and nuisance aquatic plant monitoring. This report was intended as a template for future reviews of environmental information, like the 305(b) report, and will eventually satisfy reporting content of the current required data summaries as well as new guidance like CALM (Consolidated Assessment and Listing Methodology).

Many of the water quality problems of interest to the Department of Ecology's Regional Offices are related to habitat destruction due to human influence. This is one of the areas in which collaborative work with volunteer monitoring groups, local governments, state agencies, tribes, and other federal agencies is promoted.

One important partnership has been with the USEPA and the Environmental Monitoring and Assessment Program (EMAP). The Department of Ecology has engaged both EMAP and R-EMAP (Regional Environmental Monitoring and Assessment Program) since 1994. The acquisition of both knowledge and equipment in operating this program has provided impetus to implement the probabilistic monitoring design in the Ambient River and Stream Water Quality Monitoring Program. WA is working with the Colville Tribe in expanding the description of reference conditions for northeastern Washington and with the Yakima Tribe, county, and federal agencies in evaluating the effects of floodplain gravel mining along the Yakima River. WA is especially encouraged by several volunteer monitoring groups, like Streamkeepers of Clallam County, whose organizers have assembled teams of personnel that generate useful biological, chemical, and flow data.

## Documentation and Further Information

2000 Washington State Water Quality Assessment - Section 305(b) Report: <http://www.ecy.wa.gov/pubs/0010058.pdf>

DRAFT 2002 303(d) List of Impaired and Threatened Waters, May 2002:  
<http://www.ecy.wa.gov/programs/wq/303d/2002-revised/listpolicydraftfinal7.pdf>

Condition of Freshwaters in Washington State for the Year 2000: <http://www.ecy.wa.gov/pubs/0103025.pdf>

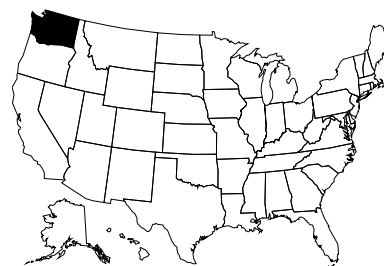
Water Quality Standards for Surface Waters of the State of Washington: <http://www.ecy.wa.gov/pubs/wac173201a.pdf>

For a comprehensive list of Stream Biological Monitoring Publications available online and/or by mail, go to:  
[http://www.ecy.wa.gov/programs/eap/fw\\_benth/fw\\_b\\_pubs.html](http://www.ecy.wa.gov/programs/eap/fw_benth/fw_b_pubs.html)

# WASHINGTON

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 email: [rplo461@ecy.wa.gov](mailto:rplo461@ecy.wa.gov)



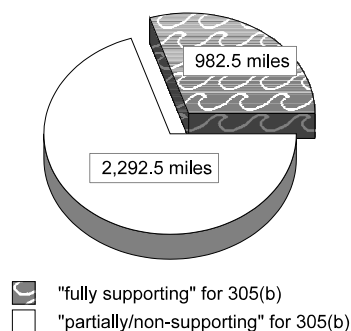
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>specific river basins or watersheds</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>comprehensive use throughout jurisdiction</i> )
	<input checked="" type="checkbox"/>	probabilistic by stream order/catchment area ( <i>stream order as subset of ecoregion sampling</i> )
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide ( <i>special projects and comprehensive use throughout jurisdiction</i> )
	<input checked="" type="checkbox"/>	rotating basin ( <i>specific river basins or watersheds</i> )
other:		

## Stream Miles

<b>Total miles</b>	<b>73,886</b>
<i>(State based determination)</i>	
Total perennial miles	39,483
<b>Total miles assessed for biology*</b>	<b>3,275</b>
fully supporting for 305(b)**	982.5
partially/non-supporting for 305(b)**	2,292.5
listed for 303(d)	0
number of sites sampled	655
number of miles assessed per site	5

## 3,275 Miles Assessed for Biology



\*Approximately 10% of the State's perennial streams are assessed for biology. The 3,275 total miles assessed for biology is an estimate derived from multiplying 655 sites by the 5 miles assessed per site.

\*\*The "fully supporting" and "partially/non-supporting" for 305(b) stream mile estimates are based on an old assessment policy estimation process. WA most recently used EPA's National Hydrography Data Layer to create the stream segment breaks but the new data has not been generated yet.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)	
<b>ALU designations in state water quality standards</b>	The Water Class system currently in use contains four categories: Class AA, Class A, Class B, and Class C. Class AA (extraordinary) freshwaters shall markedly and uniformly exceed the requirements for all or substantially all uses. Class A (excellent) freshwaters shall meet or exceed the requirements for all or substantially all uses. Class B (good) freshwaters shall meet or exceed requirements for most uses. Class C (fair) freshwaters shall meet or exceed the requirements of selected and essential uses.	
<b>Narrative Biocriteria in WQS*</b>	under development	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	none	

\*Water Classes AA, A, and B include a characteristic use designation called "Wildlife Habitat." This characteristic use designates waters of the state used by, or that directly or indirectly provide food support to fish, other aquatic life, and wildlife for any life history stage or activity. The term "biological assessment" is defined in Washington's water quality standards and is intended to be used to evaluate the condition of "Wildlife Habitat."

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>187 total</b>	
<b>Reference site determinations</b>	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	1) Least-disturbed sites that show little or no signs of human impact, 2) Relatively-unimpacted sites that show some signs of historical human influence but are at an advanced successional stage	
<b>Characterization of reference sites within a regional context</b>	<input checked="" type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: minimally disturbed (see "relatively-unimpacted" reference site criteria)
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input checked="" type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (100-500 samples/year; single season, multiple sites - watershed level and broad coverage)
	<input checked="" type="checkbox"/>	fish (100-500 samples/year; single season, multiple sites - watershed level and broad coverage)
	<input checked="" type="checkbox"/>	periphyton (<100 samples/year; single season, multiple sites - watershed level and broad coverage)
	<input checked="" type="checkbox"/>	other: macrophytes and waterfowl (<100 samples/year; single season, multiple sites - watershed level and broad coverage)
<b>Benthos</b>		
sampling gear		Surber, D-frame; 500-600 micron mesh
habitat selection		riffle/run (cobble); pool habitat may also be assessed if physical and/or chemical degradation has occurred and can be detected through a biotic response
subsample size		500 count
taxonomy		family, genus, and species
<b>Fish</b>		
sampling gear		backpack electrofisher; 7 millimeter mesh
habitat selection		multihabitat
sample processing		length measurement, anomalies
subsample		none - all specimens are examined and counted
taxonomy		species, life stage
<b>Periphyton</b>		
sampling gear		<b>natural substrate:</b> brushing/scraping device (razor, toothbrush, etc.); <b>artificial substrate:</b> collect by hand
habitat selection		multihabitat
sample processing		taxonomic identification
taxonomy		genus
<b>Habitat assessments</b>		
		visual based, quantitative measurements and hydrogeomorphology; performed with bioassessments
<b>Quality assurance program elements</b>		
		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		25 <sup>th</sup> percentile of reference population
defining impairment in a multimetric index		25 <sup>th</sup> percentile of reference population
<b>Multivariate thresholds</b>		
defining impairment in a multivariate index		Significant departure from mean of reference population
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>multi-year sampling at gradient of sites</i> )
	<input checked="" type="checkbox"/>	precision ( <i>multi-year sampling at reference sites</i> )
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		All biological (including habitat and chemistry) information is stored in MS Access
Retrieval and analysis		SAS, Systat, CANOCO, Primer, Cornell Ecology Programs, and Calibrate

# WEST VIRGINIA

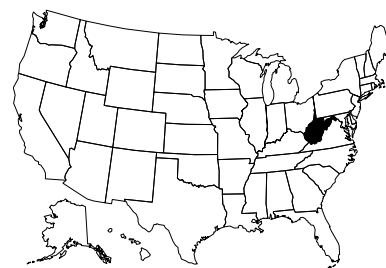
## Contact Information

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WV DEP Division of Water Resources homepage: <http://www.dep.state.wv.us/item.cfm?ssid=11>

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WV DNR Wildlife Resources Section homepage: <http://www.dnr.state.wv.us/wwwildlife/default.htm>



## Program Description

The West Virginia Department of Environmental Protection (WV DEP) implemented the Watershed Assessment Program in 1996. This program was designed to systematically measure the water quality and biological health of the state's rivers and streams. The program has four major components: 1) Random or Probabilistic Sampling; 2) Pre-TMDL sampling; 3) Ambient WQ Monitoring; and 4) "Regular Assessments."

Benthic macroinvertebrates are collected at the "random sites," regular WAP (Watershed Assessment Program) sites, and selected Pre-TMDL sites. The program utilizes a rectangular dip net, compositing samples from two square meters and identifying a 200 organism sub-sample. WV DEP identified the "bugs" in-house to family level the first three years of the program. In 1999, WV DEP contracted out the identification work and switched to genus level identification. In 2000, a macroinvertebrate index was developed for West Virginia with support from EPA's biocriteria development program. This index provides a means to establish an impairment threshold that is based on a set of minimally disturbed reference sites.

The "Regular Assessments" were the majority of WV DEP's workload in the program's first year and continue to be a major portion of efforts. These consisted of sampling as many streams as possible (considering personnel limitations) in watersheds that were scheduled for assessment according to a 5 year cycle (5-7 watersheds per year). These assessments included the collection of water quality, habitat and macroinvertebrate data. All streams previously listed as impaired were targeted for assessment, as were a portion of all "unassessed" and "partially impaired" streams.

In 1997, the Watershed Assessment Program added a probabilistic sampling component. The first 5-year cycle was completed in 2001. The first cycle consisted of sampling 30-35 sites in each of the major watersheds (8-digit HUCs) in the state, sampling all sites in a watershed in a single year. The next 5 year cycle begins in 2002 and will have a different sampling strategy. The same effort, 150 sites, will be spread across the state each year instead of just the 5-7 watersheds being assessed that year. This will allow a summary of the condition of the state's streams to be completed every year instead of having to wait for the end of the 5-year cycle. This strategy also eliminates the problem of comparing watersheds sampled in different years that may have had drastically different climactic conditions (i.e. drought versus flood).

Periphyton will be collected at all of the random sites starting in 2002. The results of these collections will hopefully aid in the development of nutrient criteria. Streams with known eutrophication problems and some of WV DEP's established reference sites may be sampled as well.

The Division of Natural Resources (DNR) is the fish and game agency of West Virginia. As part of its duties, statewide fishery surveys are conducted annually to monitor game and nongame fish populations. These surveys are not probability based as they are usually performed on target streams with ongoing programs (e.g., stockings) or due to crisis management reasons. The WV DNR has no regulatory authority relative to the state's water quality standards, but we are sometimes involved in a fish advisory capacity. The WV DNR is developing a fish Index of Biotic Integrity via a cooperative agreement with the USEPA. The IBI is being developed somewhat independently from the WQS that are utilized by WV DEP. Someday it may be used in the 305(b) program by a collaboration of agencies.

## Documentation and Further Information

WV DEP Division of Water Resources list of publications, including direct links to *West Virginia Water Quality Status Assessment 305(b) Report 2000* and other 305(b) reports, multiple 303(d) listings, *West Virginia's Monitoring Strategy*, and *A Stream Condition Index for West Virginia Wadeable Streams*, 2000: <http://www.dep.state.wv.us/item.cfm?ssid=11&ss1id=192>

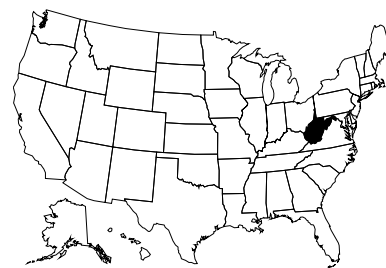
Smithson, J. 2001. Watershed assessment program. SOP. WV DEP Division of Water Resources.

# WEST VIRGINIA

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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) <i>(comprehensive use throughout jurisdiction)</i>
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide <i>(comprehensive use throughout jurisdiction)</i>
	<input checked="" type="checkbox"/>	rotating basin <i>(comprehensive use throughout jurisdiction)</i>
	<input type="checkbox"/>	other:

## Stream Miles

**Total miles** **32,278**

*(determined using RF3 augmented with all named streams on 1:24,000 topographic map)*

Total perennial miles 21,114

**Total miles assessed for biology** **5,745**

fully supporting for 305(b) 3,706

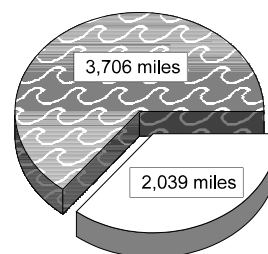
partially/non-supporting for 305(b) 2,039

listed for 303(d) 1,315

number of sites sampled 60-90

number of miles assessed per site —

5,745 Miles Assessed for Biology



■ "fully supporting" for 305(b)  
□ "partially/non-supporting" for 305(b)

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Single Aquatic Life Use
<b>ALU designations in state water quality standards</b>	Two designations: warmwater and coldwater
<b>Narrative Biocriteria in WQS</b>	none - Internal program procedures used to support general aquatic life standard
<b>Numeric Biocriteria in WQS</b>	none
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input checked="" type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Watershed restoration action strategies as part of the 319 grant program.

## Reference Site/Condition Development

<b>Number of reference sites</b>	~105 total	
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input checked="" type="checkbox"/> professional judgment <input type="checkbox"/> other:	
<b>Reference site criteria</b>	<p>The following selection criteria are used to select reference sites:            (* Indicates criterion that can be determined in the field.)</p> <p>1. D.O. &gt; 5.0mg/l* 2. pH between 6.0 and 9.0* 3. Conductivity &lt; 500 <math>\mu</math>S/cm* 4. Fecal coliform &lt; 800 colony/100ml 5. No violations of State WQ Standards 6. No obvious sources of nonpoint pollution* 7. Epifaunal substrate / available cover score &gt;10* 8. Channel alteration score &gt;10* 9. Sediment deposition score &gt;10* 10. Bank vegetative protection score &gt;5* 11. Undisturbed vegetation zone width score &gt;5* 12. Total habitat score &gt; or = 130 points* 13. Evaluation of anthropogenic activities and disturbances* 14. No known point source discharges upstream and within view of assessment site (completed after 1-13 are met)</p>	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input checked="" type="checkbox"/> other: minimally disturbed**	
<b>Stream stratification within a regional reference conditions</b>	<input type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input checked="" type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:	
<b>Additional information</b>	<input type="checkbox"/> reference sites linked to ALU <input type="checkbox"/> reference sites/condition referenced in water quality standards <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions ( <i>minimal</i> )	

\*\*WV reference sites are best described as *minimally disturbed* sites. They have to meet each of the 14 criteria mentioned above; thus there are some areas with no sites that WV DEP is comfortable calling reference.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>&gt;500 samples/year, single season, multiple sites - watershed level</i> )
	<input checked="" type="checkbox"/>	fish* ( <i>&lt;100 samples/year; single observation, limited sampling</i> )
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		D-frame, dipnet, collect by hand; 500-600 micron mesh
habitat selection		riffle/run (cobble)
subsample size		200 count
taxonomy		family, genus
<b>Fish*</b>		
sampling gear		seine, backpack and boat electrofishers, electric seine; 1/8" and 3/16" mesh
habitat selection		multihabitat
sample processing		length measurement, biomass - individual
subsample		none
taxonomy		species
<b>Habitat assessments</b>		visual based, quantitative measurements, riffle stability index; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings, training for biologists, sorting proficiency checks, sorting and taxonomic proficiency checks, specimen archival

\*West Virginia Division of Natural Resources is the fish and game agency of West Virginia. WV DNR duties include statewide annual fishery surveys to monitor game and nongame fish populations. These surveys are not probability based as they are usually performed on target streams due to ongoing programs (eg. stockings) or crisis management reasons. The WV DNR has no regulatory authority relative to the state's water quality standards, but are sometimes involved in a fish advisory capacity. The WV DNR is developing a fish Index of Biotic Integrity via a cooperative agreement with the USEPA. It is being developed somewhat independently from the quality standards that are utilized by WV DEP, and may someday be used in the 305(b) program by a collaboration of agencies.

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		95 <sup>th</sup> percentile of total population
defining impairment in a multimetric index		5 <sup>th</sup> percentile of reference sites
<b>Evaluation of performance characteristics*</b>	<input checked="" type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision
	<input checked="" type="checkbox"/>	sensitivity
	<input checked="" type="checkbox"/>	bias
	<input checked="" type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		WAPBAS (similar to EDAS)
Retrieval and analysis		WAPBAS (similar to EDAS)

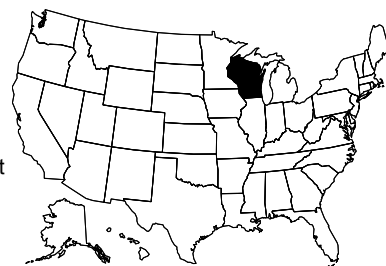
\*Described in *A Stream Condition Index for West Virginia Wadeable Streams* (see documentation and further information)



# WISCONSIN

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email: [talbot@dnr.state.wi.us](mailto:talbot@dnr.state.wi.us) and [masnar@dnr.state.wi.us](mailto:masnar@dnr.state.wi.us)  
WI DNR Division of Water homepage: <http://www.dnr.state.wi.us/environment/water.html>



## Program Description

Historically, much of the water resource assessment work done by the Wisconsin Department of Natural Resources (WDNR) has focused on the evaluation of degraded watersheds or water resources with high public profile. As a result, there is a lack of data on the overall quality of Wisconsin's water resources. In addition, monitoring techniques often varied among assessment sites and over time thus making it difficult to compare data across the state or from different time periods. To address these concerns, WDNR initiated a new program in 1999, called Baseline Monitoring. Standardized assessment techniques for aquatic habitat, macroinvertebrates and fish have been developed and are being applied throughout the state. The elements of this new program are contained in a draft report on Wisconsin's Surface Water Monitoring Strategy.

The overall goals of the baseline monitoring strategy are to answer the following questions:

1. What are the use expectations for Wisconsin's water resources?
2. Are the state's waters meeting their use potential?
3. What factors are preventing the state's water resources from meeting their potential?
4. What are the statewide status and trends in the quality of Wisconsin's surface waters?

To achieve the goals of the program, the following specific set of monitoring objectives were established:

- Determine the designated attainable uses of each waterbody. Stream and lake habitat information and fisheries data collected during baseline assessments will be compared with biological criteria obtained from "least-impacted" regional reference waters to determine the water's use classification.
- Determine the level of use attainment of each waterbody. Stream habitat and fisheries data collected during baseline assessment monitoring will allow the WDNR to determine if designated uses are being attained. More emphasis is being placed on biological monitoring to determine if designated uses are being met.
- Determine why some waterbodies are not attaining their designated uses. Physical, chemical and biological data collected during baseline assessment monitoring will provide at least some of the information required to achieve this objective.

For stream biological monitoring, WDNR collects information on riparian and in-stream habitat data, aquatic insects and fish species. The aquatic insects are identified and the numbers of fish are determined using standardized collection protocols. Lake monitoring involves collecting trophic state data and fish community data using the standardized protocols.

WDNR will begin using a stratified-random sampling approach to achieve adequate coverage of the state's 55,000 miles of streams. This sampling design allows the WDNR to sample a variety of streams and lakes across the state and also provides the Department with the ability to evaluate the quality of water resources that have not been sampled. The WDNR collects over 400 aquatic invertebrate samples per year. However, under the baseline monitoring that was initiated last year, the WDNR is now annually assessing about 600 stream sites. In the future, maps showing the location of biological sampling sites will be available.

## Documentation and Further Information

*Wisconsin Water Quality Report to Congress, 2000 305(b):* <http://www.dnr.state.wi.us/org/water/wm/watersummary/WQ.pdf>

*Wisconsin's Unified Watershed Assessment:* <http://www.dnr.state.wi.us/org/water/wm/watersummary/uwa/index.htm#intro>

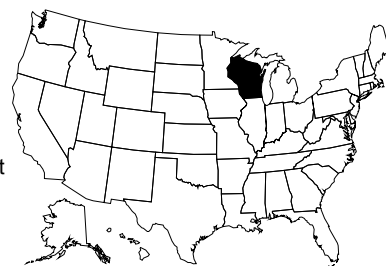
*Water Quality Standards for Wisconsin Surface Waters*, revised February 1998:  
<http://www.legis.state.wi.us/rsb/code/nr/nr102.pdf>

Wisconsin DNR Fisheries and Habitat Biological Database: [http://infotrek.er.usgs.gov/wdnr\\_bio/](http://infotrek.er.usgs.gov/wdnr_bio/)

# WISCONSIN

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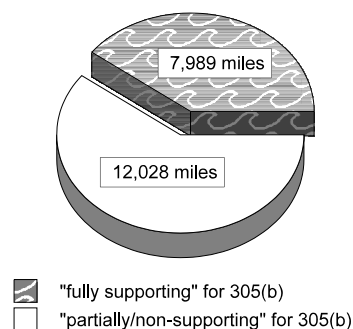
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input checked="" type="checkbox"/>	other: fishery assessments, FERC re-licensing, decisions, etc.
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles*</b>	<b>55,000</b>
Total perennial miles	32,000
<b>Total miles assessed for biology**</b>	<b>24,422</b>
fully supporting for 305(b)	7,989
partially/non-supporting for 305(b)	12,028
listed for 303(d)	—
number of sites sampled ( <i>on an annual basis</i> )	600
number of miles assessed per site**	5

## 24,422 Miles Assessed for Biology



\*Surface water resources for Wisconsin have been quantified using GIS. A 1:24,000 scale hydrography GIS database was developed by digitizing surface waters shown on USGS 7.5 minute quadrangle maps.

\*\*The miles assessed for biology include fish consumption and aquatic life use. Of the 12,394 miles fully supporting for 305(b), 4,405 miles are threatened. Each site sampled represents 5 miles of stream for baseline surveys, based on research conducted by WDNR.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Fishery Based Uses and Warm Water vs. Coldwater	
<b>ALU designations in state water quality standards</b>	Five designations: 1) Coldwater – Salmonids & some sculpin species, 2) Warm Water Fish & Aquatic Life – game fish and some important forage species, 3) Warm Water Forage Fish – forage fish communities intolerant to low dissolved oxygen, 4) Limited Forage Fish – forage fish communities tolerant of low dissolved oxygen, 5) Limited Aquatic Life – communities with non-fish species (invertebrates, etc.) that are tolerant of low dissolved oxygen.	
<b>Narrative Biocriteria in WQS</b>	Wisconsin does not have narrative biocriteria per se. It does have narrative criteria that are applied to protect against harm to human, wildlife and fish and aquatic life communities. Please see below.*	
<b>Numeric Biocriteria in WQS</b>	none	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Wisconsin's bioassessment program is still evolving, but has been used regularly to make water quality management decisions that range from fishery management issues (bag limits, habitat restoration projects) to FERC license operating conditions to assessing potential vs. actual fish & aquatic life uses of surface waters.	

\***Acute Narrative Criterion:** NR 102.04(1)(d) (d) Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant or aquatic life.

**Chronic Narrative Criterion:** NR 102.04(4)(d) (d) Other substances. Unauthorized concentrations of substances are not permitted that alone or in combination with other materials present are toxic to fish or other aquatic life. Surface waters shall meet the acute and chronic criteria as set forth in or developed pursuant to ss. NR 105.05 and 105.06. Surface waters shall meet the criteria which correspond to the appropriate fish and aquatic life subcategory for the surface water, except as provided in s. NR 104.02(3).

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>100 total</b>	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watershed
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Reference sites are defined by 1) BPJ using biota, 2) Upper quartile of biota index scores within two years, and 3) will eventually be supplemented with a <i>priori</i> land use. Also, a fish IBI is currently used, and habitat, water chemistry and macroinvertebrates will be incorporated within two years.	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input checked="" type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: will eventually use a <i>priori</i> GIS land use data
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input checked="" type="checkbox"/>	stream type ( <i>temperature, gradient, stream order</i> )
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input checked="" type="checkbox"/>	other: will assess strata with multivariate analysis
<b>Additional information</b>	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (>500 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	fish (>500 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	periphyton (<100 samples/year; single observation, limited sampling)
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		Surber, Hess, D-frame (all limited use); 500 - 600 micron mesh
habitat selection		riffle/run (cobble)
subsample size		minimum of 125, but typically 200 - 300 organisms
taxonomy		lowest taxa-level possible - usually genus, sometimes combination
<b>Fish</b>		
sampling gear		backpack and boat electrofisher, pram unit (tote barge); 1/4" mesh
habitat selection		multihabitat
sample processing		length measurement, biomass- individual (gamefish), biomass- batch (non-game), anomalies
subsample		selected species
taxonomy		species
<b>Periphyton</b>		
sampling gear		<b>natural substrate:</b> brushing/scraping device (razor, toothbrush, etc.) <b>artificial substrate:</b> rock, rip-rap, bridge concrete
habitat selection		richest habitat
sample processing		chlorophyll <i>a</i> / phaeophytin and taxonomic identification
taxonomy		diatoms only
<b>Habitat assessments</b>		quantitative measurements; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings, training for biologists, sorting and taxonomic proficiency checks, specimen archival

## Data Analysis and Interpretation

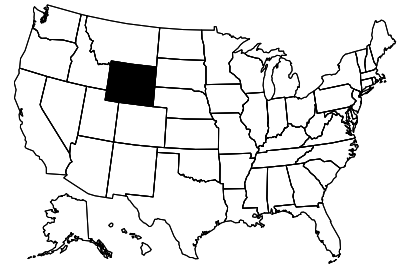
<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )*
	<input checked="" type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		25 <sup>th</sup> percentile of reference population
defining impairment in a multimetric index		25 <sup>th</sup> percentile of reference population
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision ( <i>repeat sampling of assessment sites is conducted</i> )
	<input checked="" type="checkbox"/>	sensitivity ( <i>multiple streams along various stressor gradients have been assessed to document metric sensitivity to the stressor of concern</i> )
	<input checked="" type="checkbox"/>	bias ( <i>Stream habitat assessment crews assess the same site to document crew experience bias. Least-impacted streams of differing size/stream order are sampled to document macroinvertebrate metric bias among streams of varying order</i> )
	<input checked="" type="checkbox"/>	accuracy ( <i>multiple least-impacted streams are sampled to document metric accuracy</i> )
<b>Biological data</b>		
Storage		A database has been developed in concert with USGS. It is not currently compatible with STORET. The database can be viewed at: <a href="http://www.infotrek.er.usgs.gov/wdnr_bio/">http://www.infotrek.er.usgs.gov/wdnr_bio/</a>
Retrieval and analysis		SAS, Systat, and Statistica. Also, an ORACLE-based data management system is being developed to store data and provide routine report summaries and metric calculations.

\*Multimetric indexes for habitat and fish have been developed, and a multimetric index for macroinvertebrates is being developed.

# WYOMING

## Contact Information

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WYDEQ Water Quality Division website: <http://deq.state.wy.us/wqd/index.asp?pageid=5>



## Program Description

The primary objective of bioassessments conducted by the Wyoming Department of Environmental Quality (WYDEQ) is to assess the support of aquatic life for 303(d) listing and 305(b) reporting, using macroinvertebrates as the primary indicator. The program has been in existence since 1993, when it was initiated in the form of the Reference Stream Project (RSP). The primary goal of the RSP was to collect baseline biological data at least-impacted (reference) streams in each ecoregion of Wyoming as a benchmark for assessing biological and water quality conditions of other streams across the State. In 1998, the focus shifted from collecting reference stream data to using RSP data as a benchmark to assess biological conditions of other Wyoming streams as part of the Beneficial Use Reconnaissance Program (BURP). BURP uses a comprehensive approach (chemical, physical, and biological components) to assess water quality conditions of Wyoming streams. Today, the RSP is still ongoing, but at a much smaller scale.

Several other organizations have been or will be important sources of bioassessment data in Wyoming. The Wyoming Association of Conservation Districts (WACD) has been very involved in collecting biological data at streams across Wyoming. With proper guidance, local Conservation Districts (CDs) can elect to assume some of WYDEQ's bioassessment responsibilities, with the data being used for 303(d) and 305(b). Many CDs have welcomed the opportunity to collect bioassessment data.

The USGS also has been a very important source of biological data. Wyoming has contracted the USGS-Wyoming District to carry out the Environmental Monitoring and Assessment Program (EMAP) monitoring in Wyoming. Approximately 50 randomly selected sites will be assessed over the four year contract, with the end goal being an unbiased estimate of water quality conditions in the State. The USGS also conducted an assessment of the Yellowstone River Basin of Wyoming and Montana as part of the National Water-Quality Assessment Program (NAWQA). The considerable amount of biological data generated from these studies is being evaluated for comparability with WYDEQ data to explore the usefulness of these data for 305(b) purposes. In addition, joint-funding agreements are in place with the USGS that allow for enhanced biological monitoring of streams in areas affected by coal bed methane development.

The Wyoming Game and Fish Department (WGFD) is an important source of fish data. WYDEQ has chosen not to sample fish communities as part of bioassessments, but uses WGFD data for determining support of fisheries uses, as well as in classifying streams for assignment of uses and designating appropriate water quality standards associated with those uses.

Wyoming has made significant strides in recent years in the development of multimetric biocriteria. Work will continue toward refining the existing numeric criteria and narrative aquatic life standard, and toward the eventual implementation of numeric aquatic life standards. Implementation of numeric standards is sure to be a challenging effort. The physical heterogeneity of Wyoming (e.g., climate, landscape, land use, and geology) poses significant scientific challenges. Political considerations are also likely to pose challenges.

Currently, WY is exploring the use of predictive models for assessing biological conditions of streams, as well as the addition of periphyton as an additional biological indicator to supplement macroinvertebrate data and WGFD fish data used in bioassessments. Periphyton samples have been collected at a limited number of long-term reference stations in the past, and the use of periphyton data will expand in coming years.

## Documentation and Further Information

Wyoming's 2000 305(b) State Water Quality Assessment Report and 2000 303(d) Report:  
<http://deq.state.wy.us/wqd/watershed/01452-doc.pdf>

Wyoming Surface Water Quality Standards: <http://deq.state.wy.us/wqd/index.asp?pageid=52#Stand>

Manual of SOPs for Sample Collection and Analysis: <http://deq.state.wy.us/wqd/watershed/10574-doc.pdf>

WYDEQ Water Quality Division Five-Year Comprehensive Monitoring Plan, 2001 Update, October 2001:  
<http://deq.state.wy.us/wqd/watershed/12806-doc.pdf>

Jessup, B.K. and J.B. Stribling. 2000. *Testing the Wyoming stream integrity index*. Prepared by Tetra Tech, Inc., Owings Mills, Maryland, for USEPA Region 8, Denver, CO.

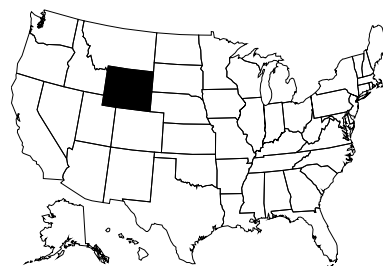
Gerritsen, J.; Jessup, B.K.; King, K.; Smith, J. and Stribling, J.B. 2000. *Development of Biological Criteria for Wyoming Streams and their Use in the TMDL Process*. Prepared by Tetra Tech, Inc., Owings Mills, Maryland, for USEPA Region 8, Denver, CO.

Data can be found online at <http://wy.water.usgs.gov/> and <http://www.wrds.uwyo.edu/>

# WYOMING

## Contact Information

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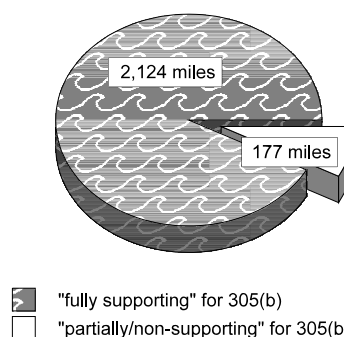
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input checked="" type="checkbox"/>	other: UAAs and site-specific standards
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>specific river basins or watersheds</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin ( <i>specific river basins or watersheds</i> )
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>113,422</b>
<i>(determined using RF3, 2000 and National Hydrography Database, 2001)</i>	
Total perennial miles	32,520
<b>Total miles assessed for biology*</b>	<b>2,639</b>
fully supporting for 305(b)	2,124
partially/non-supporting for 305(b)	177
listed for 303(d)	177
extent fully supporting, but threatened	388
number of sites sampled	700+
number of miles assessed per site	3.25

## 2,639 Miles Assessed for Biology



\*Since a Weight-of-Evidence approach is used in use support decisions, the numbers provided reflect waterbody reach extent where some type of biological data were used in the assessment.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C), Fishery Based Uses and Warm Water vs. Cold Water
<b>ALU designations in state water quality standards</b>	Game Fish (Warm Water and Cold Water Game Fish), Non-game Fish and Aquatic Life Other than Fish
<b>Narrative Biocriteria in WQS</b>	Formal/informal numeric procedures exist to support ALU decisions.
<b>Numeric Biocriteria in WQS</b>	under development (Numeric biocriteria are in use but are still being refined and are not yet incorporated in WY's water quality standards.)
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Trend analysis in watershed improvement projects and following degradation resulting from construction projects and spills.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>140</b> based on field investigation checklist <b>90</b> based on quantitative physical and chemical filters
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input checked="" type="checkbox"/> professional judgment ( <i>Best Professional Judgment based on landscape and field investigation coupled with select water chemical and physical filters</i> ) <input type="checkbox"/> other:
<b>Reference site criteria</b>	Site is identified by the field investigation to be "reference quality" based on analysis of a 27 item checklist of reach and watershed characteristics plus select ecoregion specific quantitative physical and chemical filters.
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input checked="" type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input type="checkbox"/> reference sites linked to ALU <input type="checkbox"/> reference sites/condition referenced in water quality standards <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>100-500 samples/year; single season, multiple sites – not at watershed level</i> )
	<input type="checkbox"/>	fish
	UD	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear	Surber, dipnet; 500-600 micron mesh	
habitat selection	riffle/run (cobble)	
subsample size	500 count	
taxonomy	combination--genus, species	
<b>Periphyton</b>		
sampling gear	<b>natural substrate:</b> brushing/scraping device (razor, toothbrush, etc.)	
habitat selection	riffle/run (cobble)	
sample processing	WYDEQ's periphyton program is under development. Samples have been collected, but analysis protocols are yet to be developed.	
taxonomy	under development	
<b>Habitat assessments</b>	visual based, quantitative measurements, hydrogeomorphology, pebble counts (Wolman), streambank stability (Bauer and Burton - EPA910/R-93-017), pool quality (Bauer and Burton); performed with bioassessments	
<b>Quality assurance program elements</b>	standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic proficiency checks, specimen archival	

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	UD	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores	95 <sup>th</sup> percentile of reference population	
defining impairment in a multimetric index	25 <sup>th</sup> percentile of reference population	
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>select sites are sampled annually to document annual variability</i> )
	<input checked="" type="checkbox"/>	precision ( <i>side-by-side sampling at 10% of stations; Data Quality Objectives for density and number of taxa</i> )
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage	STORET, EDAS, and internal spreadsheets	
Retrieval and analysis	EDAS	



# AMERICAN SAMOA

## Contact Information

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website: <http://www.asg-gov.com/agencies/epa.asg.htm>

## Program Description

American (Amerika) Samoa is a group of six Polynesian islands in the South Pacific. Located fourteen degrees below the equator, it is the United States' southern-most territory.

The American Samoa Environmental Protection Agency (ASEPA) develops and implements programs that protect environmental and public health from harmful impacts on air and water quality. USEPA works in partnership with ASEPA and provides funding and technical assistance to carry out environmental programs. ASEPA activities include water quality monitoring, inspecting facilities and new developments for compliance with environmental regulations, preparing responses to hazardous material releases, advocating practices that decrease and prevent pollution, and educating the public on environmental issues and practices.

American Samoa does not have a biological assessment program in place, and has no immediate plans for implementing a bioassessment program. The American Samoa Water Quality Standards contain no numeric biocriteria. Wording in standards that states that Fresh Surface Water and Wetlands "shall be protected to support the propagation of indigenous aquatic and terrestrial life" may be considered narrative criteria.

## Documentation and Further Information

Personal communication (email), Edna Buchan, 11/26/2001.

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# Commonwealth of Northern Mariana Islands (CNMI)

## Contact Information

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website: <http://www.deq.gov.mp/>

## Program Description

**NOTE: Since few freshwater sources exist on the islands, all information in this program summary refers to CNMI's marine environments (CNMI has only two or three, very small, perennial streams. CNMI's dynamic tropical marine system requires different approaches and techniques than are used by the states to develop biocriteria.)**

The objective of CNMI's Marine Monitoring Program is to monitor CNMI's reefs, lagoon, and reef flats with regards to benthic communities, macroinvertebrate and fish abundances, and water quality. In addition, CNMI has a biodiversity list of all organisms encountered in CNMI and a reference collection. CNMI Water Quality Standards clearly state that benthic communities can not be altered due to a discharge (Section 7.12 (d)). Any significant changes would be changes from 1) previous conditions at the same site or 2) changes from a similar reference site. The goal is to gather as much baseline data in as many different areas as possible to use for comparisons. Last year, a "State of the Reef Report" was completed which comprises all of the results from monitoring efforts.

In 2001, the focus was on assessments of nearshore coral reef systems surrounding Saipan and Rota. The 2000/2001 *State of the Reef Reports* were produced summarizing past and present coral reef data for Saipan and Rota. Though it would be impossible to survey the entire coral reef system around CNMI with current resources, there are approximately 20 sites established for intensive data collection on a yearly basis. The goal is to continue to enhance CNMI's interagency marine monitoring group composed of Coastal Resources Management, Division of Fish and Wildlife, and Division of Environmental Quality. Assessments of existing and additional sites on Rota, Saipan, Tinian, and other Northern Islands will be conducted and included in the next Reef Report (2002). Data will be used for future assessments of natural disasters, potential anthropogenic disturbances/development, and overall biological health.

In 2002, the entire Saipan Lagoon, covering several watersheds, will also be surveyed to assess and understand how upland runoff (nonpoint source pollution) may be affecting this valuable resource. The entire lagoon will be divided into habitats and quantitative and qualitative data from each habitat will be gathered. Once completed, existing aerial photographs will be scanned and remote sensing techniques will delineate the habitats found. The end result will be used to examine correlations between water quality, drainage areas, other areas of concern, and the lagoon habitat. This project is also required by the Army Corps of Engineers in order to proceed with a master drainage plan for areas associated with Saipan's Lagoon. Lagoon survey work is currently a joint project between NOAA's Coastal Resource Management Program and DEQ. Hopefully, the Division of Fish and Wildlife will be involved in this project in 2002 as well.

CNMI's reef monitoring program is based on site selection. Sites that have "concerns" or "disturbances" are selected, as well as several reference sites. There are many more habitats in the nearshore coral reef communities around CNMI than are found in the Saipan Lagoon, hence the difference in methods. Also, weather conditions prohibit surveys on windward sides of the islands most of the year. All of this data is very useful for understanding baseline water quality conditions, and these data are used for assessment when and if projects are proposed that involve a discharge.

CNMI's program can not follow the same type of biocriteria monitoring program implemented in any of the U.S. states. There is a very dynamic tropical marine system surrounding CNMI which warrants the use of techniques different than those used by our State counterparts.

## Documentation and Further Information

*Commonwealth of Northern Mariana Islands Water Quality Assessment Report 305(b)*, April 2000

*Commonwealth of Northern Mariana Islands Water Quality Assessment Report 305(b)*, 2002  
(Interested parties can contact Peter Houk, CNMI DEQ, or EPA Region 9 for a copy of either report)

*CNMI State of the Reef Report*, 2000

CNMI Nonpoint Source and Marine Monitoring Program information: <http://www.deq.gov.mp/NPS/default.htm>

# Commonwealth of Northern Mariana Islands

## Contact Information

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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	other: public information and awareness
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

### Stream Miles\* (pertains to coral reef monitoring)

<b>Total miles</b>	—
Total perennial miles	—
<b>Total miles assessed for biology</b>	<b>n/a</b>
fully supporting for 305(b)	n/a
partially/non-supporting for 305(b)	n/a
listed for 303(d)	n/a
number of sites sampled on the reef ( <i>on an annual basis</i> )	20
number of miles assessed per site	site specific

\*The above section is not applicable to CNMI's monitoring program since no stream monitoring is conducted. For lagoon surveys, CNMI plans to intensively survey and create habitat maps for the entire Saipan Lagoon system. This covers several watersheds. CNMI's outer reef monitoring program is based on site selection - sites that have "concerns" or "disturbances," as well as several reference sites. There are many more habitats in the nearshore coral reef communities around CNMI than are found in the Saipan Lagoon, hence the difference in methods. Also, weather conditions prohibit surveys on windward sides of the islands most of the year. All of these data are very useful for understanding baseline water quality conditions, and these data are used for assessment when and if projects are proposed that involve a discharge.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)	
<b>ALU designations in state water quality standards</b>	AA - top quality marine, A - marine non-recreational 1 - surface water (runoff mainly, no rivers) highest quality, 2 - surface water non-recreational	
<b>Narrative Biocriteria in WQS</b>	Formal/informal numeric procedures used to support narrative biocriteria are determined by the best available data.	
<b>Numeric Biocriteria in WQS</b>	none (Numeric biocriteria are located in yearly reports on monitoring activities. Each site differs with respect to benthic communities and CNMI's WQS uses the term "shall not differ substantially from those where similar conditions exist.")	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input type="checkbox"/>	cause and effect determinations
	<input type="checkbox"/>	permitted discharges
	<input type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	A ponding basin was established on Rota Island in response to CNMI DEQ's monitoring results. There are also other small projects similar to this. DEQ is collecting baseline data with the intention of using it to assess BMPs and aid future decision-making.	

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>5 total</b>	
<b>Reference site determinations</b>	<input checked="" type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: based on benthic community composition
<b>Reference site criteria</b>	Reference sites are chosen based on similar geological/physical features (slope, substrate, etc.). They are sites similar in community composition that are not subjected to the discharge in question. There are usually several on each island in CNMI.	
<b>Characterization of reference sites within a regional context</b>  <i>Not applicable*</i>	<input type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>  <i>Not applicable</i>	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input checked="" type="checkbox"/>	reference sites linked to ALU ( <i>in some cases</i> )
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions ( <i>in some cases</i> )

\*Characterization of reference sites does not apply because CNMI uses a degree of community change based on reference versus test sites.

## Field and Lab Methods\*

Assemblages assessed	<input checked="" type="checkbox"/>	benthos (<100 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	fish (<100 samples/year; single season, multiple sites - broad coverage)
	<input type="checkbox"/>	periphyton
	<input checked="" type="checkbox"/>	other: waterfowl (100-500 samples/year; multiple seasons, multiple sites - broad coverage for watershed level)
Benthos*		
sampling gear	Transect lines, underwater photo equipment, hammer, measuring tapes, diving gear, underwater slates/pencils	
taxonomy	genus and species	
Fish*		
sampling gear	speargun, reference books	
taxonomy	species	
Habitat assessments	quantitative measurements, benthic coverage estimates of major benthos, basic water quality parameter measurements, abundances of fish and macroinvertebrates, and biodiversity of all organisms present; performed with bioassessments	
Quality assurance program elements	standard operating procedures, quality assurance plan, periodic meetings and training for biologists, and specimen archival	

\*Following is a summary of biological sampling methods used in the reef – see CNMI's *State of the Reef Report* for details

- Three 50 meter transect lines are secured parallel to the shoreline (laid end-to-end, 150m total length), and marked with a sediment trap holder and re-bar driven securely into the reef.
- For benthics, an underwater camera is used to take still photographs of .5-m quadrats placed at all even numbers along the transect line. For each photo the bottom right corner of the quadrat is aligned with the corresponding transect line distance.
- Coral communities are examined using the point-quarter method described by Randall et al., (1988). A dive knife is haphazardly tossed 16 times along the three transects. For each toss the distance to the nearest living coral colony is noted for each of four quadrants, as well as the diameter and taxonomic name.
- Fish abundance is determined by a single observer swimming along the transect lines recording data. Counts of all fishes within 5 meters of each side of the transect line are recorded. Fishes are identified to the family level.
- All macroinvertebrates within 2 meters of each side of the transect line are counted. These data were presented as abundances per (100-m<sup>2</sup>) of reef on each of three transects. Macroinvertebrates are either identified to genus or grouped by life form, depending on abundances.
- Sediment traps provide sedimentation rate data from sites where sedimentation is a concern.
- Water samples are taken for chemistry.

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input type="checkbox"/>	biological metrics
	<input type="checkbox"/>	disturbance gradients
	<input checked="" type="checkbox"/>	other: distribution analysis and cluster analysis
<b>Multivariate thresholds</b>		
defining impairment in a multivariate index	5 <sup>th</sup> percentile of reference population (Pvalue of .05 is cut off)	
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage	MS Access, Excel, Word, Arcview GIS and Photo documentation	
Retrieval and analysis	Excel	

# PUERTO RICO and the U.S. VIRGIN ISLANDS



## Contact Information

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## Program Description

Puerto Rico is presently evaluating Rapid Bioassessment Protocols (RBPs) for mountain streams. According to the Water Monitoring Plan for fiscal year 2002, the Puerto Rico Environmental Quality Board (PREQB), in coordination with EPA Region II, will continue to work on the development of biological indicators for stream monitoring. PREQB is responsible for current monitoring activities which include ambient water quality monitoring, intensive water quality studies, and 305(b) reporting. The 2000 Cycle 305(b) Report doesn't include any biological information (aside from limited wetland loss data). The EPA (ORD Coastal 2000 Program) conducted an EMAP study on the estuaries of Puerto Rico, which included benthic macroinvertebrate sampling.

The *U.S. Virgin Islands 2000 Water Quality Assessment* reported that there are "no perennial streams on any of the islands; intermittent streams can only be seen after heavy rainfall. The absence of large freshwater resources and perennial streams means that *guts* (watercourses) form the basis for watershed management in the territory." Also, the Virgin Islands primarily assess coastal waters and estuaries, but "no monitoring for biological effects is conducted for lack of baseline standards for Virgin Islands conditions. According to the Virgin Islands multi-year monitoring strategy, the Department of Planning and Natural Resources (DPNR) will explore options for implementing a biological component of the Ambient Monitoring Program. This may include developing a partnership with NOAA or another agency with similar monitoring objectives."

## Documentation and Further Information

*Goals and Progress of Statewide Water Quality Management Planning: Puerto Rico 1998-1999, 2000 Cycle 305(b) Report.* Puerto Rico Environmental Quality Board. November 2000.

*2000 Water Quality Assessment for the United States Virgin Islands, 2000 305(b) Report.* Department of Planning and Natural Resources, Division of Environmental Protection (DPNR/DEP). April 2001.

# PUERTO RICO and the U.S. VIRGIN ISLANDS



## Contact Information

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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>  <i>Not currently used</i>	<input type="checkbox"/>	problem identification (screening)
	<input type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/>	monitoring the effectiveness of BMPs
	<input type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
<b>Applicable monitoring designs</b>	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>special projects only</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

**NOTE:** These stream and river miles apply only to Puerto Rico.  
The U.S. Virgin Islands reports no stream miles.

<b>Total miles</b>	<b>5,394.2</b>
<i>(determined using RF3)</i>	
Total perennial miles	—
<b>Total miles assessed for biology*</b>	<b>0</b>
fully supporting for 305(b)	n/a
partially/non-supporting for 305(b)	n/a
listed for 303(d)	n/a
number of sites sampled	n/a
number of miles assessed per site	n/a

\*Specific biological studies have been conducted, but there are no ongoing projects. However, Puerto Rico does conduct other regular chemical and physical monitoring. According to PR's 2000 305(b) report, during the 1998 - 1999 monitoring cycle there were 5,394 total assessed miles; 4,297 evaluated segments; and 1,096 monitored segments. Of the 1,096.7 river miles monitored for Aquatic Life Use, 222.4 miles were determined to be fully supporting, 16.8 miles were partially supporting, and 857.5 miles were non-supporting.



## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Class System (A,B,C)
<b>ALU designations in state water quality standards</b>	Standards list definitions for the following: pelagic and planktonic species, propagation and preservation of desirable species.
<b>Narrative Biocriteria in WQS</b>	none (Puerto Rico and the U.S. Virgin Islands have no biocriteria. According to Puerto Rico's 2000 305(b) report, there were expectations of achieving/developing some, but no monitoring strategy has been submitted as of yet.)
<b>Numeric Biocriteria in WQS</b>	none
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input type="checkbox"/> assessment of aquatic resources <input type="checkbox"/> cause and effect determinations <input type="checkbox"/> permitted discharges <input type="checkbox"/> monitoring (e.g., improvements after mitigation)
<i>Not currently used</i>	<input type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	none

## Reference Site/Condition Development\*

<b>Number of reference sites</b>	none
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input type="checkbox"/> regional (aggregate of sites) <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Reference site criteria</b>	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input type="checkbox"/> reference sites linked to ALU <input type="checkbox"/> reference sites/condition referenced in water quality standards <input type="checkbox"/> some reference sites represent acceptable human-induced conditions

\*This section is not applicable – no biological monitoring is conducted in Puerto Rico or the U.S. Virgin Islands, thus neither territory has reference sites.

## Field and Lab Methods\*

<b>Assemblages assessed</b>	<input type="checkbox"/>	benthos
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Habitat assessments</b>	not applicable	
<b>Quality assurance program elements</b>	not applicable	

## Data Analysis and Interpretation\*

<b>Data analysis tools and methods</b>	<input type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input type="checkbox"/>	biological metrics
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Evaluation of performance characteristics</b>	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage	not applicable	
Retrieval and analysis	not applicable	

\*These sections are not applicable since no biological monitoring is conducted in Puerto Rico or the U.S. Virgin Islands.

# CONFEDERATED TRIBES OF THE COLVILLE RESERVATION



## Contact Information

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Confederated Tribes of the Colville Reservation  
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website: <http://www.colvilletribes.com/>

## Program Description

The Colville Indian Reservation land base covers 1.4 million acres or 2,100 square acres located in North Central Washington, primarily in Okanogan and Ferry counties. The Reservation consists of tribally owned lands held in federal trust status for the Confederated Tribes, land owned by individual Colville tribal members (most of which is held in federal trust status), and land owned by others (described as fee property and taxable by counties). Colville Reservation lands are diverse with natural resources including standing timber, streams, rivers, lakes, minerals, varied terrain, native plants and wildlife.

Although the Confederated Tribes of the Colville Reservation do have federally approved water quality standards, the Tribes' Office of Environmental Trust doesn't use biological assessment methods as a means to assess water quality. In 2001, the Tribes gave permission to the State of Washington Department of Ecology to conduct some biological assessments on the reservation, but the results of those surveys are not yet complete. The primary obstacle to conducting bioassessment has been cost. The water quality monitoring program is reevaluated every year, and it is possible the Tribes may implement biological monitoring in the future.

## Documentation and Further Information

Personal Communication (email), Gary Passmore, 11/28/2001.

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# NEZ PERCE TRIBE

## Contact Information

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website: <http://www.nezperce.org/>



## Program Description

The Nez Perce Reservation is located in North Central Idaho. The Tribal Department of Natural Resources consists of the Land Services, Cultural Resources, Wildlife Resources, Forest Resources, Water Resources, and Environmental Restoration and Waste Management Programs. These programs focus on delivering resource management services on the Reservation and participating in the planning and decisions of land management activities affecting the Nez Perce Treaty area. The programs provide protection of reserved treaty-rights in all areas to their best abilities. Department administration is structured to facilitate an interdisciplinary approach in meeting these needs.

Currently the Tribe is collecting baseline chemical and physical habitat data on Reservation waterbodies and will, eventually, be establishing its own water quality standards for the reservation area. The Nez Perce Tribe may soon promulgate the standards USEPA is developing for Indian country, with the idea of refining them from narrative standards to both chemical and biological criteria. The Tribe has used the State of Idaho Beneficial Use Assessment Procedure (BURP) for reservation water bodies in 1997, 1998 and 1999 and would like to adopt its own protocols for beneficial use assessment.

The Tribe recently obtained funds to begin the EMAP bioassessment procedure for the reservation. This will be accomplished through participation in the EMAP Western Pilot and methods will be developed based on EMAP protocols.

## Documentation and Further Information

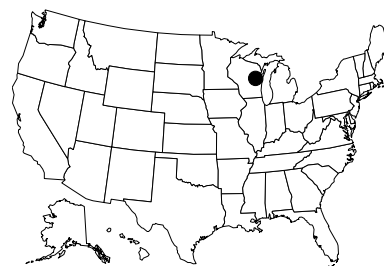
Personal Communication (email), Ann Storrar, 10/01/2001.

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# ONEIDA NATION OF WISCONSIN

## Contact Information

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website: <http://www.oneidanation.org>



## Program Description

### Objectives

The Oneida Tribe's current and future uses of information gathered using bioassessment include protection, restoration, assessing impacts, monitoring changes, as well as driving policy and promoting knowledge and appreciation of aquatic resources.

### Background

Although there had been some invertebrate and fish surveys performed on the Reservation over the last twenty years or so, the development of a formal biological monitoring program was initiated in 2000. Tri-annual fishery surveys at established monitoring sites have been performed since 1997. In 1999, the Tribe began sampling invertebrate communities and immediately began using the findings as tools. An onsite aquatic invertebrate taxonomy laboratory was also established in 1999 and equipped with scopes, literature, drying oven, hood, etc. In 2000, qualitative sampling of invertebrates was performed at five stream sites and a quantitative study of one lake was initiated to determine the effectiveness of BMPs in the surrounding basin. In the meantime, SOPs were developed for qualitative and quantitative methods for lakes and wadeable streams and metrics were researched and tested. Contracts were set up for the picking and sorting of invertebrate samples (UW-Superior) and for toxicity testing (Environmental Consulting and Testing) of certain waterbodies. In 2001, quantitative samples were collected at three stream sites and the lake, as well as three more sites being sampled qualitatively. Stream types have not been formalized, but four reference sites have been established:

1. **Thornberry Creek** (at forest Drive), a first order cold water system, exhibiting "pristine" conditions during 1999 and 2000.
2. **Trout Creek** (at County FF), a 3<sup>rd</sup> order cold water system, exhibiting "good" to "very good" conditions.
3. **Oneida Creek** (at VanBoxtel Road), a 3<sup>rd</sup> order cool water system, exhibiting "good" conditions in 2000. A very rare fingernet caddisfly, *Wormaldia moesta*, known to occur only in "small, cold, rapid streams" has been collected at this site.
4. **Duck Creek** (at Seminary Road), a 4<sup>th</sup> order warm water system, the largest stream on the Reservation. The water quality and invertebrate community represent "good" conditions. The same stream is in "poor" condition before entering the Reservation from the south near the Town of Freedom.

The streams at these sites represent the reference conditions for all stream types on the Reservation. In 2002, qualitative or quantitative sampling will be conducted at approximately 30 invertebrate sites and mid-summer fish IBIs will be conducted at eleven sites.

### Setting/Land Use

The entire Reservation, covering approximately 64,500 acres, is in the Southeastern Wisconsin Till Plains ecoregion (Omernick 1987). At this time, the main sources of impairment are sedimentation (construction and agriculture) and nutrients (agriculture, suburban lawns, golf courses). The Reservation straddles the boundary of Brown and Outagamie Counties and includes all or portions of the City of Green Bay, Villages of Ashwaubenon and Howard, and the Towns of Hobart, Oneida and Pittsfield. Eleven additional municipalities rest within the watersheds flowing through the Reservation. All surface waters within the Oneida Reservation drain to the Great Lakes Basin (Lake Michigan). There are four separate surface water drainages, bearing numerous tributaries:

- 1) Duck Creek River – Fish Creek, Oneida Creek, Trout Creek, Lancaster Brook, Beaver Dam Creek, Silver Creek (*Lower Green Bay Basin*); 2) South Branch of the Suamico River (*Upper Green Bay Basin*); 3) Ashwaubenon Creek – North Branch, South Branch, Hemlock Creeks (*Fox River Basin*); and 4) Dutchman Creek (*Fox River Basin*)

Land use percentages surrounding the sites will be mapped this summer (2002), and the first formal biomonitoring report is being produced.

### Metrics and Biocriteria Development

While the Oneida Nation does not have federally approved water quality standards, the Tribe is implementing a water quality program with bioassessment surveys under tribal law. The inclusion of biocriteria into the Tribe's WQS has been delayed due to urgent water resource issues that have come up, rather than lack of information. The appropriate metrics to accurately predict responses in benthic invertebrate communities for the area are fairly well proven at this time. The metrics currently being used (for streams) are the Hilsenhoff Biotic Index (HBI), Taxa Richness, dominance, percent clingers and in some cases Ephemeroptera, Plecoptera and Trichoptera (EPT) and E, P and T taken separately. The most common impacts are due to sedimentation and organic loading. Because of the limited number and type of streams within the Reservation, it is believed that the appropriate reference sites to represent all of the stream types have been selected. A final designation of these has not been made, nor are biocriteria being submitted for inclusion in the WQS until there is a chance to conduct more sampling of test sites to compare with the reference sites.

## Documentation and Further Information

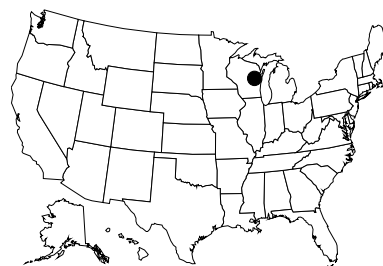
Personal communication (letter), James L. Snitgen, 1/2002.

Hard copies of documents including the Oneida Nation's WQS; SOPs for the Qualitative Sampling (#BI002) and Quantitative Sampling (#BI003) of Streams for Benthic Invertebrates; Annual Water Resources Report (future reports will contain fish and macroinvertebrate data)

# ONEIDA NATION OF WISCONSIN

## Contact Information

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 P.O. Box 365, 3759 W. Mason Street ■ Oneida, WI 54155  
 Phone 920/497-5812 ■ Fax 920/496-7883  
 email: [jsnitgen@oneidanation.org](mailto:jsnitgen@oneidanation.org)



## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose)
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations)
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	<b>233</b>
Total perennial miles	—
<b>Total miles assessed for biology</b>	—
fully supporting for 305(b)	n/a
partially/non-supporting for 305(b)	n/a
listed for 303(d)	n/a
number of sites sampled ( <i>in summer 2002</i> )	41
number of miles assessed per site	~0.02 miles (25 meters)



## Aquatic Life Use (ALU) Designations and Decision-Making\*

<b>ALU designation basis</b>	Warm Water vs. Cold Water
<b>ALU designations in state water quality standards</b>	Two designations: cold water ecosystems, warm water ecosystems
<b>Narrative Biocriteria in WQS</b>	Inclusion of narrative and numeric biocriteria into the Tribe's WQS is under development, as is nutrient criteria. Tribal WQS include biological and water quality language but this does not constitute formal biocriteria.
<b>Numeric Biocriteria in WQS</b>	see above
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	Macroinvertebrate community data were used to designate one stream as a cold water resource. RBPs were conducted following a stormwater spill.

\*Water quality standards were federally approved in 1996 and then rescinded following a lawsuit.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>4 total</b>
<b>Reference site determinations</b>	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watershed <input type="checkbox"/> regional (aggregate of sites) <input checked="" type="checkbox"/> professional judgment ( <i>Qualitative data gathered initially on candidate reference sites. Most "pristine" of each stream type used as reference--still in early stages of determining all necessary reference sites</i> ) <input type="checkbox"/> other:
<b>Reference site criteria</b>	water quality, benthic invertebrate community (Hilsenhoff Biotic Index), land use, physical habitat, geomorphology, qualitative benthos investigations
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input checked="" type="checkbox"/> stream type ( <i>all within Reservation/all in same ecoregion</i> ) <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
<b>Additional information</b>	<input type="checkbox"/> UD reference sites linked to ALU <input type="checkbox"/> UD reference sites/condition referenced in water quality standards <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

## Field and Lab Methods\*

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (<100 samples per year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	fish (<100 samples per year; multiple seasons, multiple sites - broad coverage for watershed level)
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		Surber, D-frame, collect by hand; 500 micron mesh
habitat selection		riffle/run (cobble)
subsample size		300 count
taxonomy		species
<b>Fish</b>		
sampling gear		backpack electrofisher; 1/4" mesh
habitat selection		previously established monitoring sites and/or sites suitable for long term monitoring
sample processing		biomass - individual (identify and count)
subsample		none
taxonomy		species
<b>Habitat assessments</b>		visual based, quantitative measurements; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

\*The Oneida Nation has sampled fish for four years and began a macroinvertebrate program in 2001 using the RBP habitat rating score sheet. The Tribe's first herpetile survey is planned for summer 2002 to collect baseline data on two riverways and three wetlands. Oneida also plans to begin using macrophytes as indicators in wetlands.

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index and return single metrics</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		information not provided
defining impairment in a multimetric index		information not provided
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision (replicates)
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		Macroinvertebrate data in Corel Quattro Pro; fish data in MS Access
Retrieval and analysis		information not provided

# PASSAMAQUODDY TRIBE, PLEASANT POINT RESERVATION

## Contact Information

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Passamaquoddy Tribe at Pleasant Point  
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website: <http://www.wabanaki.com>



## Program Description

The Passamaquoddy Tribe at Pleasant Point is located in coastal Maine, near the border of New Brunswick. The Tribe's Environmental Department is responsible for the health of the natural resources under Tribal Management. This responsibility begins by assessing and mapping these resources and related risks, then developing programs to insure that these natural resources are protected. While the Passamaquoddy Tribe does not have federally approved water quality standards, it is implementing a water quality program with limited bioassessment surveys under tribal law. Current water quality work includes testing salt water for fecal coliform and phytoplankton in a cooperative arrangement with the Maine Department of Marine Resources (DMR) and the Cobscook Bay Resource Center. This work provides the DMR with information to manage closure of clam flats.

## Documentation and Further Information

Personal communication (email), Deirdre Whitehead, 11/30/2001.

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# PYRAMID LAKE PAIUTE TRIBE

## Contact Information

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## Program Description

The Pyramid Lake Paiute Tribe's Reservation is located thirty five miles northeast of Reno, Nevada in a remote desert area situated in the counties of Washoe, Lyon, and Storey. The area of the reservation contains 475,000 acres or 742.2 square miles.

The Environmental Department of the Pyramid Lake Paiute Tribe (PLPT) has been conducting bioassessments on waterbodies within the reservation border since 1975. An ecological study on Pyramid Lake was conducted from 1975 through 1977. A comprehensive bioassessment study was conducted on the lower Truckee River during the summer of 1981. In 1989, a regular Rapid Bioassessment (RBA) program was established for the Truckee River, following the first EPA bioassessment training in Reno, Nevada.

PLPT is in the process of establishing standardized protocols for assessing the biological and physical conditions of Wadeable streams within the exterior boundaries of the Pyramid Lake Paiute Indian Reservation. The Tribe will use protocols outlined in EPA's Rapid Bioassessment Protocols (USEPA 1989). There are plans to incorporate the bench sheets and protocols as outlined by the California Department of Fish and Game (CA DFG) Water Pollution Control Laboratory in their *California Stream Bioassessment Procedure* (May 1999). These technical documents describe RBA in more detail. Updating and developing aquatic/riparian RBA techniques is an ongoing process.

The PLPT RBA program will ensure that the information generated can be compatible with the National or State EPA bioassessment program, to produce high quality and reliable assessments of stream habitat and water quality. A professional aquatic biologist/entomologist will act as the project team leader, backed by an interdisciplinary team of two to four biologists and/or technicians.

Fish and benthic macroinvertebrates (BMIs) will be identified to the lowest taxonomic level possible (genus/species). The presence or absence of fish and BMIs are proven indicators of an impaired or healthy aquatic system. Bioassessments can be used to detect impairments to aquatic communities from point and nonpoint sources of pollution and for assessing ambient biological condition. The upper third of riffles will be targeted for collecting biological samples because they are the richest habitat for BMIs in Wadeable streams. The Tribe's goal is to protect an endangered lake sucker called a "Cui-ui" (*Chasmistes cujus*), and the threatened Lahontan Cutthroat Trout.

In summer 2001, the Tribe initiated a RBA program for springs and wetlands. A wetland specialist will act as team leader, looking at amphibians, wildlife, BMIs, birds, plants, and water chemistry for each waterbody as indicators of an impaired or healthy aquatic system.

In the future, PLPT plans to explore numeric biocriteria for BMIs on the Truckee River. The Tribe will also begin gathering baseline data on the five streams that surround Pyramid Lake. The Tribe's water quality standards are currently undergoing review by EPA.

## Documentation and Further Information

Personal communication (letter), Dan Mosely, 2001.

The following PLPT department homepages are under development (July 2002):

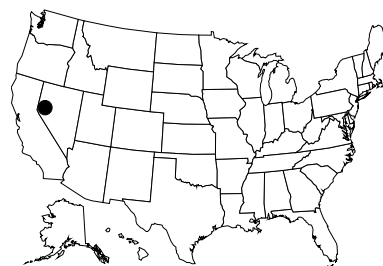
Environmental Department: <http://plpt.nsn.us/modules.php?name=Sections&sop=listarticles&secid=21>

Water Resources Department: <http://plpt.nsn.us/modules.php?name=Sections&sop=listarticles&secid=20>

# PYRAMID LAKE PAIUTE TRIBE

## Contact Information

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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/> UD	monitoring the effectiveness of BMPs
	<input type="checkbox"/> UD	ALU determinations/ambient monitoring ( <i>to be developed</i> )
	<input type="checkbox"/> UD	promulgated into tribal water quality standards as narrative biocriteria
	<input type="checkbox"/> UD	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input type="checkbox"/> UD	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>specific river basins or watersheds</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations)
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles</b>	—
Total perennial miles	—
<b>Total miles assessed for biology</b>	<b>31+</b>
fully supporting for 305(b)	—
partially/non-supporting for 305(b)	—
listed for 303(d)	—
number of sites sampled*	13 to 15
number of miles assessed per site	—

\*Eight to ten sites are sampled on the Truckee River, covering 31 miles. Five sites on five streams surrounding Pyramid Lake are also sampled.

## Aquatic Life Use (ALU) Designations and Decision-Making

<b>ALU designation basis</b>	Fishery Based Uses	
<b>ALU designations in state water quality standards</b>	under development	
<b>Narrative Biocriteria in WQS</b>	under development (Narrative biocriteria are incorporated into Pyramid Lake's water quality standards, but are currently awaiting approval by EPA Region 9. No formal/informal numeric procedures are used to support narrative biocriteria.)	
<b>Numeric Biocriteria in WQS</b>	under development (The Pyramid Lake Paiute Tribe will be developing "scientifically defensible" numeric biocriteria for the Lower Truckee River over the next several years.)	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input type="checkbox"/> UD	cause and effect determinations
	<input type="checkbox"/> UD	permitted discharges
	<input type="checkbox"/> UD	monitoring (e.g., improvements after mitigation)
	<input type="checkbox"/> UD	watershed based management
<b>Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	presently none - to be developed	

## Reference Site/Condition Development\*

<b>Number of reference sites</b>	under development	
<b>Reference site determinations</b>	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Based on historical data, what the best conditions <u>should be</u> for that site. On Truckee River, the Tribe has been using reference "conditions" based on bioassessment data from 1981 to present.	
<b>Characterization of reference sites within a regional context</b>	<input checked="" type="checkbox"/>	historical conditions
	<input type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input checked="" type="checkbox"/>	elevation
	<input checked="" type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input checked="" type="checkbox"/>	jurisdictional ( <i>within Tribe's boundaries</i> )
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input type="checkbox"/> UD	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input type="checkbox"/>	some reference sites represent acceptable human-induced conditions

\*Reference site use is currently under development.

## Field and Lab Methods

<b>Assemblages assessed*</b>	<input checked="" type="checkbox"/>	benthos (<100 samples/year [3 replicates per riffle site]; single season, multiple sites - not at watershed level)
	<input checked="" type="checkbox"/>	fish
	<input checked="" type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		surber (used 1981 through 2000), kicknet (started in 2001) - 9" x 18" rectangle 500 micron mesh
habitat selection		richest habitat - upper third of riffle
subsample size		entire sample
taxonomy		genus and species
<b>Fish</b>		
sampling gear		seine (multiple gill nets), backpack and boat electrofisher
habitat selection		pool/glide
sample processing		length measurement, biomass - individual, anomalies
subsample		study specific
taxonomy		species
<b>Periphyton</b>		
sampling gear		<b>natural substrate:</b> brushing/scraping device (razor, toothbrush, etc.) <b>artificial substrate:</b> collect by hand
habitat selection		multihabitat
sample processing		chlorophyll <i>a</i> / phaeophytin, biomass, taxonomic identification
taxonomy		all algae; species level; genus level for soft-bodied algae when possible; diatoms are not cleared
<b>Habitat assessments</b>		visual based and quantitative measurements; performed with bioassessments
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologist, sorting and taxonomic proficiency checks, specimen archival

\*Tribal Fisheries conducts fish bioassessments and a Tribal Wetlands staff member conducts amphibian biostudies. Periphyton sampling is conducted on tribal land by the Desert Research Institute.

## Data Analysis and Interpretation\*\*

<b>Data analysis tools and methods</b>	<input type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input type="checkbox"/>	biological metrics
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Evaluation of performance characteristics</b>	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		Quattro Pro and paper files
Retrieval and analysis		EDAS (under development)

\*\*Data have not yet been analyzed or evaluated. Pyramid Lake Paiute Tribe is just beginning to sort/identify the 2001 benthic macroinvertebrate collections.



# SEMINOLE TRIBE of FLORIDA

## Contact Information

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## Program Description

The reservations that comprise the Seminole Tribe of Florida begin around Tampa and extend into the southern tip of the state. The Tribe's Water Resource Management Department is responsible for protecting the land and water systems within the Reservation while ensuring a sustainable economic and cultural future for the Tribe. USEPA has delegated to the Tribe the authority to implement the Clean Water Act within the Tribe's jurisdiction. As part of that program, the Tribe implemented a sophisticated monitoring program, adopted federally approved water quality standards for the Big Cypress reservation, and is developing standards for the other reservations.

The Tribe has developed other programs, as well, including spill prevention plans for above ground storage tanks and removal programs for underground storage tank facilities. The Tribe actively participates in a number of task forces, working groups, and commissions regarding the restoration of the South Florida ecosystem. The Tribe spends considerable resources supporting the overall design and implementation of South Florida's environmental restoration.

Currently the Tribe does not use biocriteria in any of its water quality monitoring programs. However, the Tribe is involved in a research project conducted by Florida Atlantic University that includes development of biocriteria (primarily for variations in hydroperiod and the effects of restoration), using vegetation and fish as bioindicators.

## Documentation and Further Information

Personal communication (email), Bill Dunson, 12/4/2001.

Working Drafts – Bioindicators for wetland change; Presentation on use of data in conducting rapid wetland assessments

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# Delaware River Basin Commission (DRBC)

Interstate compact: PA, NJ, NY, DE



## Contact Information

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## Program Description

The objectives of the Commission's biological monitoring program are presently focused upon the 200-mile long non-tidal Delaware River corridor:

1. Protection of high quality aquatic life uses in Water Quality Zones 1A through 1E of the Delaware River, from Hancock, New York to Trenton, New Jersey
2. Development of anti-degradation biological criteria based upon existing water quality
3. Definition of longitudinal changes in benthic community structure along the Delaware River corridor, to support decisions to maintain or improve water quality where necessary

DRBC and the National Park Service (NPS) have operated the Scenic Rivers Monitoring Program since the early 1980s. The Commission has never used biological criteria for 305(b) assessments or determinations of impairment, other than reports arising from fish-tissue toxics analysis and inference of aquatic life use attainment based upon water chemistry. Macroinvertebrate biocriteria were developed for DRBC's Special Protection Waters rules issued in 1990, but the criteria were later found to be based upon inconsistent and non-representative methods, and have not been used as envisioned during development of the Commission's anti-degradation policies.

With the launch of DRBC's Lower Delaware Monitoring Program in 1999, declaration of most of the non-tidal Delaware River as Wild and Scenic in 2000, and major efforts to update DRBC's comprehensive plan and water quality standards (applicable to most of the Delaware River), interest in DRBC's biomonitoring program was renewed. Meetings with state and local partners resulted in the decision that the Commission would bear the primary responsibility for biological monitoring of the Delaware River, while each state would regulate and monitor tributaries. With technical support and advice from NJDEP, PADEP, USGS, USEPA Region 3, NPS, and the Academy of Natural Sciences, DRBC set out to define goals, objectives, and methods for improving its biological assessment program for the river.

DRBC investigated large-river bioassessment methods and decided to wait for issuance of EPA's large-rivers guidance before launching large-scale monitoring in difficult habitats such as pools, rapids, and upper-estuarine reaches. In 2001, DRBC initiated an annual benthic survey in 2001 of wadeable riffle, run, and island margin habitats, to develop a benthic index of biological integrity for the non-tidal river. The annual August/September low-flow survey is narrowly defined to eliminate spatial and temporal variability, enabling site-to-site, reach-to-reach, and year-to-year comparison of results. By 2005, DRBC hopes to have enough data to create a low-flow benthic IBI (B-IBI) for wadeable portions of the Delaware River, and to apply the B-IBI to future 305(b) assessments and protection of existing water quality.

The Commission would like to monitor other assemblages in order to gain a more complete picture of the ecological integrity of the Delaware River, and to measure progress toward objectives defined by the Commission's comprehensive plan. DRBC is investigating methods to assess submerged aquatic vegetation, periphyton, fish, mussels, plankton, invasive exotic species, and ecological characterization of over 50 unique microhabitats observed in the river. These investigations have been scheduled on a rotating basis as special studies, though they are not used in use support and/or impairment determinations.

Within the next year, DRBC and the NPS will begin planning for tributary Boundary Control Point biomonitoring. DRBC will establish locations and methods to define existing water quality and create biological targets at each location for antidegradation purposes. With the river survey in progress, this is an appropriate next step in improving biomonitoring coverage and implementing antidegradation policies. DRBC is also moving away from doing taxonomy in-house due to a lack of both time and work space. The identification work from the annual river survey will likely be contracted out sometime in the near future.

## Documentation and Further Information

*Delaware River & Bay Water Quality Assessment, 2000 305(b) report:* [http://www.state.nj.us/drbc/2K305b\\_text.PDF](http://www.state.nj.us/drbc/2K305b_text.PDF)

*DRBC Annual Report 2000:* <http://www.state.nj.us/drbc/ar2000.htm>

*DRBC Quality Assurance Project Plan 2001 Update:* <http://www.state.nj.us/drbc/QAplanLDEL01.PDF>

*DRBC Publications homepage:* <http://www.state.nj.us/drbc/public.htm>

*2001 Biomonitoring Work Plan* (contains numerous citations, including three reports on DRBC's 3-year bioassessment study, issued by the Academy of Natural Sciences, Patrick Environmental Research Center with recommendations on how best to proceed with update of biocriteria and implementation of antidegradation as mandated in DRBC's Water Quality Standards)

# Delaware River Basin Commission (DRBC)

Interstate compact: PA, NJ, NY, DE



## Contact Information

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## Programmatic Elements

Uses of bioassessment within overall water quality program	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
Applicable monitoring designs	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects and specific river basins or watersheds</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input type="checkbox"/>	rotating basin
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles*</b>	<b>200</b>
<i>(total miles of mainstem segment only, not including tributaries; determined using RF3 - Interstate river corridor is well-defined by river reaches, not watershed based)</i>	
Total perennial miles	unknown
<b>Total miles assessed for biology</b>	<b>200</b>
fully supporting for 305(b)**	n/a
partially/non-supporting for 305(b)**	n/a
listed for 303(d)**	n/a
number of sites sampled ( <i>on an annual basis</i> )	23
number of miles assessed per site***	~8.7

\*DRBC is an Interstate Compact encompassing river miles in four states: Pennsylvania, New Jersey, New York and Delaware, and has not determined the number of total stream miles in the Basin. The Delaware River Basin watershed encompasses 13,539 square miles. Bioassessment and biocriteria activities are concentrated on a 200-mile non-tidal segment of the Delaware River and tributary boundary control points.

\*\*Biocriteria are not currently used for the 305(b) report. Biocriteria were developed years ago, but the extent of their application is unknown.

\*\*\*The number of miles assessed per site (~8.7) is very rough. DRBC's goal is to sample approximately 10 additional sites, thus reducing this number.

## Aquatic Life Use (ALU) Designations and Decision-Making\*

<b>ALU designation basis</b>	Single Aquatic Life Use and Fishery Based Uses	
<b>ALU designations in state water quality standards</b>	Two designations: The fishery-based designation is general, narrative, and defined by river zone. The single aquatic life use designation is macroinvertebrate criteria within DRBC's Special Protection Waters areas, and is defined for antidegradation purposes.	
<b>Narrative Biocriteria in WQS</b>	See definition of Existing Water Quality in Special Protection Waters (found in the 2001 workplan) for procedures used to support narrative biocriteria.*	
<b>Numeric Biocriteria in WQS</b>	See DRBC's <i>Administrative Manual – Part III, Water Quality Regulations</i> , Section 3.10.3 Stream Quality Objectives, Section A. Antidegradation of Waters, Table 1.*	
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input type="checkbox"/>	permitted discharges
	<input type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	DRBC/NPS attempted to use existing criteria to define perceived problem areas. The existing criteria, as defined, could not distinguish anthropogenic versus natural measurable change. Program redesign is necessary.	

\*Application of the existing system has been unsuccessful thus far due to the low priority given to biomonitoring. Program redesign recommendations were recently made to improve effectiveness and applicability of the criteria. Criteria for the entire non-tidal river are currently being updated, and a best-habitat based benthic IBI that might eventually be applied to future 305(b) assessments and the protection of existing water quality is under development. Additional data will be required, as well as a clear definition of how the criteria will be applied to the 305(b) process. Separate criteria will be required for the river, the tributaries, and for different levels of application and interpretation.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>23 total</b>	
<b>Reference site determinations</b>	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: aggregate sites in each river reach were used to define existing water quality for antidegradation purposes.**
<b>Reference site criteria</b>	In known high-quality waters numeric definition of Existing Water Quality provides a reference for comparison. Measurable Change determines departure from the reference condition.	
<b>Characterization of reference sites within a regional context</b>	<input checked="" type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>  <i>UD - tributaries are assessed according to methods used by states to facilitate comparability and data sharing</i>	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input checked="" type="checkbox"/>	reference sites linked to ALU ( <i>not well linked</i> )
	<input checked="" type="checkbox"/>	reference sites/condition referenced in water quality standards ( <i>found in water quality standards</i> )
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions ( <i>exceptional water quality was defined under 1980's New York City reservoir operations &amp; dischargers</i> )

\*\*The program's purpose is to protect the high quality of the river; therefore all sites sampled could be theoretically considered reference sites (the same sites are continually sampled each year and findings are compared to the original samples' data to determine if the quality has changed).

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (<100 samples/year; single season, multiple sites)
	<input checked="" type="checkbox"/>	fish* (<100 samples/year; single season, multiple sites)
	<input type="checkbox"/>	periphyton
	<input checked="" type="checkbox"/>	other: macrophytes (<100 samples/year; single season, multiple sites)
<b>Benthos</b>		
sampling gear		Surber, Hess, D-frame (500 - 600 micron mesh), BFN = Big-River Frame Net (custom rectangular net, bottom frame area .37 square meters, for Delaware River to 3ft deep, 4 fps, 500 micron mesh)
habitat selection		richest habitat, riffle/run (cobble), multihabitat
subsample size		tributaries - entire sample; river - 200 count
taxonomy		tributaries - family; river - genus
<b>Habitat assessments</b>		
		visual based, hydrogeomorphology, pebble counts, Pfankuch Flow characterization, Simon Channel Evolution Status; mostly performed with bioassessments, some performed independent of bioassessments
<b>Quality assurance program elements</b>		
		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

\*Some fish tissue data are collected as part of DRBC's monitoring program, but the work is contracted out to NJDEP and the Academy of Natural Sciences in Philadelphia. DRBC also makes use of PADEP, PA Fish and Boat Commission, and USGS NAWQA study data in water quality assessments.

The Delaware Estuary Program recently assembled an interstate committee to standardize fish advisories in interstate waters. DRBC has had trouble in the past with making use attainment calls based upon state fish advisories. Each state sampled different areas, species, and used different criteria. Conflicts among the different states' data arose when DRBC tried to pull everything together for the Delaware River assessment. DRBC's focus upon interstate coordination and cooperation to improve the process has subsequently increased.

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>return single metrics - use endpoint for each single metric</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		95 <sup>th</sup> percentile of all sites
<b>Evaluation of performance characteristics**</b>		
	<input checked="" type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision
	<input checked="" type="checkbox"/>	sensitivity
	<input checked="" type="checkbox"/>	bias
	<input checked="" type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		STORET, SAS, MS Access and Excel
Retrieval and analysis		SAS

\*\*See reports issued by the Academy of Natural Sciences (ANS) for an evaluation. ANS identified problems with performance characteristics depending on the level of data interpretation. A redesign of the program is necessary, including refinement of the biocriteria, and field and laboratory practices.

# Interstate Commission on the Potomac River Basin (ICPRB)

Interstate compact: VA, WV, MD, PA, DC



## Contact Information

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## Program Description

ICPRB has no water/land ownership, management or regulatory authority, and therefore has set no water quality standards. However, since the Commission's creation in 1940, ICPRB often assists the basin states (Virginia, Maryland, West Virginia and Pennsylvania), the District of Columbia, and the federal government on such formulations. As part of this assistance, ICPRB conducts stream bioassessments, both fish and benthic, consults with the jurisdictions regarding current and proposed biocriteria and water quality standards, and works with the jurisdictions' data to better understand and characterize the environmental conditions of the Potomac River watershed and associated land usages.

ICPRB is currently working to integrate data from many sources (Virginia, Maryland, West Virginia, Pennsylvania, the District of Columbia, various federal and local governments, and nongovernmental sources) into a single reference watershed analysis. In addition to benthic and fish monitoring in streams and wadeable rivers, ICPRB is doing shad and herring restoration work in non-wadeable rivers. The stream data collected downstream of reservoirs, influences reservoir management decisions. The Commission also analyzes estuary data collected by other entities and works on Chesapeake Bay water quality issues.

## Documentation and Further Information

*Potomac Basin Water Quality Assessment* home (with links to District of Columbia, Maryland, Pennsylvania, Virginia and West Virginia 305(b) and 303(d) information): <http://www.potomacriver.org/wqassess.htm>

*Map of 303(d)-Listed Waters in the Potomac Basin:* <http://www.potomacriver.org/wq303d.htm>

*Virginia DEQ Water Quality Assessment Guidance Manual for 2002, 305(b) Water Quality Report and 303(d) Impaired Waters List*, amended July 2002: <http://www.deq.state.va.us/pdf/water/wqassessguide.pdf>

*2000 Maryland Section 305(b) Water Quality Report, with Appendix E, Assessment Methodology*, August 2000: [http://dnrweb.dnr.state.md.us/download/bays/MD2000\\_305b.pdf](http://dnrweb.dnr.state.md.us/download/bays/MD2000_305b.pdf)

*Commonwealth of Pennsylvania 2000 Water Quality Assessment 305(b) Report:*  
[http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305\\_wq2000\\_narr.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/305_wq2000_narr.htm)

For a link to *West Virginia Water Quality Status Assessment 2000 305(b) Report for the period 1997-1999*, go to: <http://www.dep.state.wv.us/item.cfm?ssid=11&ss1id=192>

For a list of ICPRB publications and ordering information, go to: <http://www.potomacriver.org/publications.htm>

# Interstate Commission on the Potomac River Basin (ICPRB)

Interstate compact: VA, WV, MD, PA, DC



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## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects and specific river basins or watersheds</i> )
	<input type="checkbox"/>	fixed station (i.e., water quality monitoring stations)
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin ( <i>special projects and specific river basins or watersheds</i> )
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles*</b>	<b>383</b>
<i>(total miles of Potomac River mainstem, not including tributaries)</i>	
Total perennial miles	—
<b>Total miles assessed for biology**</b>	<b>n/a</b>
fully supporting for 305(b)	n/a
partially/non-supporting for 305(b)	n/a
listed for 303(d)	n/a
number of sites sampled*	~1,300
number of miles assessed per site	—

\*The Potomac River drainage area includes 14,670 square miles in the following jurisdictions: Maryland, Virginia, West Virginia, Pennsylvania and the District of Columbia.

\*\*ICPRB is not a regulatory authority, but assists the states in the Potomac River Basin (ICPRB doesn't develop own criteria, etc.). The Commission looks at the basin as a whole, across state lines, and thus has no way of producing an accurate estimate of miles assessed. Although ICPRB works with the data from roughly 1,300 sampling stations, sampling is only conducted at several hundred of those stations – these include the samples collected and provided to Pennsylvania's Potomac Watershed Program. The rest of the stations are sampled by various state agencies who supply ICPRB with data to analyze and use for management decisions.



## Aquatic Life Use (ALU) Designations and Decision-Making\*

ALU designation basis	n/a	
ALU designations in state water quality standards	n/a	
Narrative Biocriteria in WQS	n/a	
Numeric Biocriteria in WQS	n/a	
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	✓	assessment of aquatic resources
	n/a	cause and effect determinations
	n/a	permitted discharges
	✓	monitoring (e.g., improvements after mitigation)
	✓	watershed based management
Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	Not applicable for ICPRB, but member jurisdictions in the Potomac basin use data in various ways.	

\*ICPRB does not define aquatic life uses, but uses those designated by member jurisdictions: Virginia, Maryland, West Virginia, Pennsylvania, and the District of Columbia.

## Reference Site/Condition Development\*\*

Number of reference sites	under development	
Reference site determinations	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
Reference site criteria	Under development. Each member jurisdiction has its own reference site criteria. ICPRB is working to establish regional reference sites using the "common elements" of the various jurisdictions' habitat evaluations and water quality information. The criteria will be based on water quality data and habitat parameters, and possibly macroinvertebrate data as well. The reference sites will be the least disturbed sites based on these parameters.	
Characterization of reference sites within a regional context	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input checked="" type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
Stream stratification within regional reference conditions	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input checked="" type="checkbox"/>	jurisdictional (i.e., statewide)
Additional information	<input type="checkbox"/>	other:
	n/a	reference sites linked to ALU
	n/a	reference sites/condition referenced in water quality standards
		some reference sites represent acceptable human-induced conditions

\*\*Reference sites are presently defined by statistical category (example: 95<sup>th</sup> percentile), but ICPRB would prefer to establish hypothetical reference conditions.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input checked="" type="checkbox"/>	fish (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
	<input type="checkbox"/>	periphyton
	<input checked="" type="checkbox"/>	other: phytoplankton and zooplankton (<100 samples/year; multiple seasons, multiple sites – broad coverage for watershed level)
<b>Benthos</b>		
sampling gear		kick net (1 meter); 200-400 micron mesh
habitat selection		riffle/run (cobble)
subsample size		entire sample
taxonomy		family
<b>Fish</b>		
sampling gear		backpack electrofisher, seine; 1/4" mesh
habitat selection		multihabitat
sample processing		length measurement and anomalies
subsample		selected species, batch
taxonomy		species
<b>Habitat assessments</b>		visual based; performed with bioassessments
<b>Quality assurance program elements</b>		ICPRB follows QA protocols according to each state's requirements. Elements include periodic meetings and training for biologists, taxonomic proficiency checks, and a certification program for bioassessment.

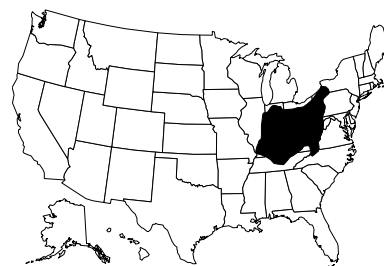
## Data Analysis and Interpretation\*

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		Current emphasis is on the 95 <sup>th</sup> percentile of all sites (reference and stressed) and a quadrisection of the range. Presently testing various published methods of establishing scoring thresholds in each jurisdiction.
defining impairment in a multimetric index		Consistent thresholds are currently being assembled from impairment criteria applied by member states.
<b>Evaluation of performance characteristics</b>		
<i>Not currently evaluated</i>	<input type="checkbox"/>	repeat sampling
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		Raw data and documentation are obtained from state and federal agencies in varying formats (hardcopy, disc, downloadable ftp files). Data are stored and analyzed using a custom-developed MS Access database similar to EDAS.
Retrieval and analysis		Various statistical software applications are being evaluated; i.e. S-PLUS, Total Access Statistics, et al.

\*The objective of the *Basinwide Assessments* program is to integrate and analyze monitoring data from member states' nontidal rivers and streams. While states' data cannot be compared directly, most apply a similar data analysis approach. ICPRB is adapting this analysis framework by selecting and normalizing consistent criteria from the various approaches to define reference and stressed conditions. Invertebrate communities at these sites will be measured and compared. Candidate metrics are also being screened for assessment accuracy and redundancy to select core metrics.

# Ohio River Valley Water Sanitation Commission (ORSANCO)

Interstate compact: NY, VA, PA, WV, OH, KY, IN, IL



## Contact Information

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## Program Description

The strategic objective of ORSANCO's Biological Program is to conduct biological monitoring of the Ohio River in order to determine the extent to which the objective of Article 1 of the Compact "...that the Ohio River be capable of maintaining fish and other aquatic life" is met. Tasks conducted in support of this strategic objective include: 1) Developing techniques for biological monitoring of large rivers in general, and the Ohio River in particular, and 2) Utilizing biological monitoring, assessment, and criteria to characterize the condition of the river. ORSANCO is currently developing numeric biological criteria and plans to integrate biological methods into overall monitoring and assessment efforts.

ORSANCO has been collecting biological data from the Ohio River since 1957 with the initiation of a lockchamber rotenone sampling program, which continues to this day. This method has provided the Commission with a 45-year look at fish community changes within the Ohio River.

ORSANCO is collecting biological data from the Ohio River on behalf of the eight states of the Commission (NY, VA, PA, WV, OH, KY, IN, and IL). These states rely on the Commission to develop appropriate methods, conduct sampling, develop assessment indices and eventually incorporate biological information into all assessment strategies. The states are also relying on ORSANCO to assist them in conducting similar programs on the large Ohio River tributaries within each state.

The Commission uses biological data in a report to each of the states which the states then use for their 305(b) report and 303(d) listings. The Commission is currently in the process of developing numeric biological criteria. Discussions are underway to determine whether the Commission should proceed with referencing biological criteria in Pollution Control Standards for the Ohio River, or incorporating said criteria as 'hard numbers' or codified criteria. ORSANCO will proceed at the recommendation of the states.

ORSANCO is also expanding its programs, including biological efforts, into the tributaries and reaches of the basin. In the very near future, ORSANCO will be working with the states to conduct biological sampling on larger, navigable, tributaries to test methods, develop indices, and eventually expand the coverage of biocriteria. The tributary work will be important in determining how to transition from great rivers to large rivers, in terms of monitoring and assessment, and will enable researchers to make that transition seamlessly.

## Documentation and Further Information

*ORSANCO 1998 305(b) Fact Sheet for the Ohio River*

ORSANCO Water Quality Protection, *Biological Program* homepage: <http://www.orsanco.org/watqual/aquatic/biological.htm>

2000 Kentucky Report to Congress on Water Quality, 305(b) report, November 2000:  
[http://water.nr.state.ky.us/wq/305b/2000/2000\\_305b.htm](http://water.nr.state.ky.us/wq/305b/2000/2000_305b.htm)

1998 Kentucky Report to Congress on Water Quality, 305(b) report, January 1999 (sites sampled by ORSANCO found in Table 2): <http://water.nr.state.ky.us/305b/>

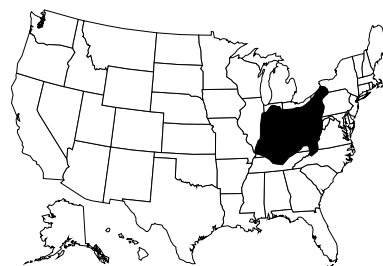
For a list of publications (including QA/QC documents, monitoring and assessment strategies, data summaries, etc.), go to:  
<http://www.orsanco.org/rivinfo/pubs/pubs.htm>

# Ohio River Valley Water Sanitation Commission (ORSANCO)

Interstate compact: NY, VA, PA, WV, OH, KY, IN, IL

## Contact Information

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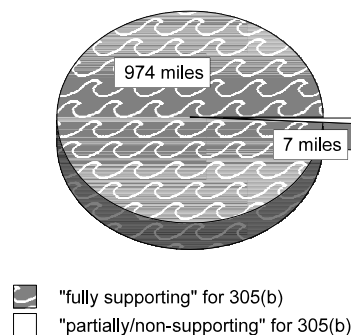
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program*</b>	✓	problem identification (screening)
	UD	nonpoint source assessments
	UD	monitoring the effectiveness of BMPs
	✓	ALU determinations/ambient monitoring
	✓	promulgated into state water quality standards as biocriteria
	UD	support of antidegradation
	UD	evaluation of discharge permit conditions
	UD	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>		other:
	✓	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	✓	fixed station (i.e., water quality monitoring stations) ( <i>special projects only</i> )
	UD	probabilistic by stream order/catchment area
	UD	probabilistic by ecoregion, or statewide
		rotating basin
		other:

## Stream Miles

<b>Total miles</b>	<b>981</b>
<i>(total miles of mainstem only, not including tributaries)</i>	
Total perennial miles	—
<b>Total miles assessed for biology*</b>	<b>981</b>
fully supporting for 305(b)*	974
partially/non-supporting for 305(b)*	7
listed for 303(d)*	55
number of sites sampled ( <i>on an annual basis</i> )	>1,000
number of miles assessed per site	0.5

## 981 Miles Assessed for Biology



\*The Ohio River flows through or borders six states: Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia. It encompasses 203,940 square miles, but ORSANCO only conducts biological monitoring on the mainstem of the Ohio River, which is 981 miles long. ORSANCO produces a 305(b) report exclusively for the Ohio River, and this document is referenced by different states for use in their own 305(b) reports. Fifty-five Ohio River miles are listed on Kentucky's 303(d) list, but this number is based on a past report and the Kentucky Division of Water feels that there is not enough biological data to delist those miles quite yet.

## Aquatic Life Use (ALU) Designations and Decision-Making\*

<b>ALU designation basis</b>	Single Aquatic Life Use
<b>ALU designations in state water quality standards</b>	One designation: Warmwater Aquatic Life – other categories are under development
<b>Narrative Biocriteria in WQS*</b>	Formal/informal numeric procedures used to support narrative biocriteria are under development.
<b>Numeric Biocriteria in WQS*</b>	under development (to be included or referenced by standards)
<b>Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)</b>	<input checked="" type="checkbox"/> assessment of aquatic resources
	<input checked="" type="checkbox"/> cause and effect determinations
	<input type="checkbox"/> permitted discharges
	<input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/> watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>	This is currently unknown because numeric biocriteria are just being proposed for the water quality standards.

\*ORSANCO's water quality standards are the adopted standards that serve as recommendations to states for incorporation into their own standards. ORSANCO is entering review this year (starting with a fish biocriteria proposal); ALU designations and numeric biocriteria are expected to be completed sometime before 2004.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>400 total</b>
<b>Reference site determinations</b>	<input checked="" type="checkbox"/> site-specific
	<input type="checkbox"/> paired watersheds
	<input checked="" type="checkbox"/> regional (aggregate of sites)
	<input checked="" type="checkbox"/> professional judgment
	<input type="checkbox"/> other:
<b>Reference site criteria</b>	Least impacted sites are sites out of the immediate influence of human impact. Specifically, one kilometer below discharges or major tributaries as well as free from other obvious disturbance. Least impacted sites are used as a surrogate for reference sites.
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/> historical conditions
	<input checked="" type="checkbox"/> least disturbed sites
	<input type="checkbox"/> gradient response
	<input type="checkbox"/> professional judgment
	<input type="checkbox"/> other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/> ecoregions (or some aggregate)**
	<input type="checkbox"/> elevation
	<input type="checkbox"/> stream type
	<input type="checkbox"/> multivariate grouping
	<input type="checkbox"/> jurisdictional (i.e., statewide)
	<input type="checkbox"/> other:
<b>Additional information</b>	<input checked="" type="checkbox"/> reference sites linked to ALU
	<input type="checkbox"/> reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

\*\*Plans are underway to develop a tiered aquatic life use approach with expectations based on river reach (ecoregion surrogate) and habitat type.

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>100-500 samples/year; multiple seasons, multiple sites – broad coverage for watershed level</i> )
	<input checked="" type="checkbox"/>	fish ( <i>100-500 samples/year; multiple seasons, multiple sites – broad coverage for watershed level</i> )
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<b>Benthos</b>		
sampling gear		multiplate; standard #30 sieve
habitat selection		multihabitat
subsample size		entire sample
taxonomy		lowest possible level
<b>Fish</b>		
sampling gear		boat electrofisher; 1/4" mesh
habitat selection		multihabitat
sample processing		length measurement, biomass - individual, anomalies
subsample		none
taxonomy		species and subspecies
<b>Habitat assessments</b>		ORSANCO has developed a habitat assessment approach and habitat index for the Ohio River. The index is based on substrate composition (broad categories), depth and cover estimates; these are performed with bioassessments.
<b>Quality assurance program elements</b>		standard operating procedures, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival. There are plans to develop a certification program for bioassessment.

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input checked="" type="checkbox"/>	parametric ANOVAs
	<input checked="" type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input checked="" type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		25 <sup>th</sup> percentile of reference population
defining impairment in a multimetric index		25 <sup>th</sup> percentile of reference population
<b>Evaluation of performance characteristics</b>	<input checked="" type="checkbox"/>	repeat sampling ( <i>look at site variability</i> )
	<input type="checkbox"/>	precision
	<input checked="" type="checkbox"/>	sensitivity ( <i>look at metrics and index performance</i> )
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<b>Biological data</b>		
Storage		MS Access
Retrieval and analysis		Statistica

# Susquehanna River Basin Commission (SRBC)

Interstate compact: NY, PA, MD



## Contact Information

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## Program Description

The Susquehanna River Basin Commission (SRBC) is the governing agency established to protect and wisely manage the water resources of the Susquehanna River Basin. The Susquehanna River starts in Cooperstown, NY and flows 444 miles to Havre de Grace, MD, where the river meets the Chesapeake Bay. The watershed encompasses parts of New York, Pennsylvania, and Maryland. Currently, SRBC implements several programs assessing the biological condition of streams and rivers, including the Subbasin Survey and Interstate Water Quality Monitoring Network (ISWQN) Programs.

Six subbasins exist in the Susquehanna River Basin: the Chemung, Upper Susquehanna, Middle Susquehanna, West Branch Susquehanna, Juniata, and Lower Susquehanna. SRBC samples each subbasin on a rotating schedule, assessing each approximately every ten years. The assessment evaluates the chemical, biological, and habitat conditions of streams, identifies major sources of pollution, documents changes in stream quality over time, and identifies areas for more intensive study. This program was initiated in 1982 and was refined in 1998 to include a more intensive second year of sampling to address specific local concerns, such as restoration and protection. Year 1 includes collection of macroinvertebrate samples and physical habitat information using Rapid Bioassessment Protocol (RBP) III, water quality collection, and flow measurement in a single-sampling event during baseflow conditions. Year 2 of the program can include a variety of projects, such as more intensive bimonthly water quality sampling to provide information to watershed groups for protection and restoration efforts. All data collected during SRBC's subbasin surveys are used in reporting to the USEPA under Section 305(b) of the Clean Water Act.

The ISWQN program, initiated in 1986, includes periodic collection of water quality and biological samples, as well as physical habitat assessments of interstate streams. Water quality data are collected quarterly and are used to assess compliance with water quality standards, characterize stream quality and seasonal variations, build a database for assessing water quality trends, and identify areas for restoration and protection. SRBC staff collect macroinvertebrate and physical habitat information annually from 51 sites on interstate streams along the New York-Pennsylvania and Pennsylvania-Maryland borders using RBP III methods. Water samples and flow information are collected at 19 sites quarterly and 30 sites yearly. Water quality data also are used to determine the existence and magnitude of trends for selected parameters. All data collected during SRBC's interstate streams surveys are used in 305(b) reporting to USEPA.

Currently, SRBC is initiating a pilot project to determine proper methods of assessing the biological conditions, using benthic macroinvertebrate populations, of the large rivers in the Susquehanna River Basin. The pilot project will take place on the Susquehanna River between Windsor, NY and Sayre, PA, during late summer 2002. Three separate methodologies will be tested: RBP III, artificial substrate samplers, and a diver operated dome (suction) sampler. A habitat assessment will be performed and water quality samples will also be taken at each site. Data will be used to select and calculate metrics for a benthic Index of Biotic Integrity to assess the biological conditions of the large rivers in the Susquehanna River Basin and will be included in 305(b) reporting.

## Documentation and Further Information

2000 Susquehanna River Basin Commission 305(b) Narrative

*The 1998 Susquehanna River Basin Water Quality Assessment 305(b) Report:* [http://www.srbc.net/docs/305bReport\\_201.pdf](http://www.srbc.net/docs/305bReport_201.pdf)

Report Announcement - *2002 Susquehanna River Basin Water Quality Assessment 305(b) Report*, Publication No. 220:  
[http://www.srbc.net/docs/summary\\_may02.PDF](http://www.srbc.net/docs/summary_may02.PDF)

Report Announcement - *Water Quality of Interstate Streams in the Susquehanna River Basin*, Publication No. 211:  
<http://www.srbc.net/pub211summary.pdf>

*Assessment of Interstate Streams in the Susquehanna River Basin: 1997-1998*, Monitoring Report #12, June 1999:  
<http://www.srbc.net/docs/iswq97-98.pdf>

*Upper Susquehanna Subbasin: A Water Quality and Biological Assessment*, 1999: <http://www.srbc.net/docs/pub203.pdf>

# Susquehanna River Basin Commission (SRBC)

Interstate compact: NY, PA, MD



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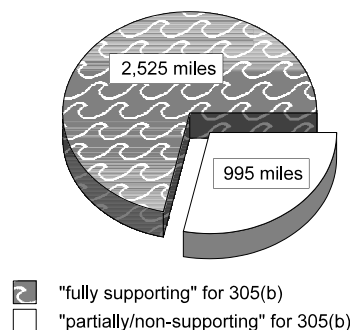
## Programmatic Elements

<b>Uses of bioassessment within overall water quality program</b>	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input type="checkbox"/>	support of antidegradation
	<input type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
<b>Applicable monitoring designs</b>	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) ( <i>special projects only</i> )
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) ( <i>specific river basins or watersheds</i> )
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input type="checkbox"/>	probabilistic by ecoregion, or statewide
	<input checked="" type="checkbox"/>	rotating basin ( <i>comprehensive use throughout jurisdiction</i> )
	<input type="checkbox"/>	other:

## Stream Miles

<b>Total miles*</b>	<b>31,193</b>
Total perennial miles	—
<b>Total miles assessed for biology</b>	<b>3,520</b>
fully supporting for 305(b)**	2,525
partially/non-supporting for 305(b)**	995
listed for 303(d)	n/a
number of sites sampled ( <i>on an annual basis</i> )	317
number of miles assessed per site	11

## 3,520 Miles Assessed for Biology



\*Stream mile estimate is based on the 1993 EPA document, *Total Waters Estimates for United States Streams and Lakes: Total Waters Database and Reporting Program*. Monitoring Branch Assessment and Watershed Protection Division, Office of Wetlands, Oceans, and Watersheds, Office of Water, Washington, D.C.

\*\*305(b) reporting is for SRBC benefit, USEPA requirements (contracts), and to provide more samples for states to use in their official 305(b) and 303(d) listings.



## Aquatic Life Use (ALU) Designations and Decision-Making\*

<b>ALU designation basis</b>		
<b>ALU designations in state water quality standards</b>		
<b>Narrative Biocriteria in WQS</b>		
<b>Numeric Biocriteria in WQS</b>		
<b>Uses of bioassessment data in integrated assessments with other environmental data</b> (e.g., toxicity testing and chemical specific criteria)	<input type="checkbox"/>	assessment of aquatic resources
	<input type="checkbox"/>	cause and effect determinations
	<input type="checkbox"/>	permitted discharges
	<input type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input type="checkbox"/>	watershed based management
<b>Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU</b>		

\*This section is not applicable to SRBC's biological monitoring program. SRBC does not define aquatic life uses, but utilizes those designated by member jurisdictions: Maryland, New York, and Pennsylvania.

## Reference Site/Condition Development

<b>Number of reference sites</b>	<b>total number varies according to project</b>	
<b>Reference site determinations</b>	<input type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input checked="" type="checkbox"/>	regional (aggregate of sites)
	<input checked="" type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Reference site criteria</b>	Habitat disturbance, best available conditions of the biological and chemical components	
<b>Characterization of reference sites within a regional context</b>	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
<b>Stream stratification within regional reference conditions</b>	<input checked="" type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input type="checkbox"/>	other:
<b>Additional information</b>	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

## Field and Lab Methods

<b>Assemblages assessed</b>	<input checked="" type="checkbox"/>	benthos ( <i>100-500 samples/year; single season, multiple sites - broad coverage</i> )
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
<hr/>		
<b>Benthos</b>		
sampling gear		D-frame, kick net (1 meter); 500-600 micron mesh
habitat selection		riffle/run (cobble)
subsample size		100 count
taxonomy		genus
<hr/>		
<b>Habitat assessments</b>		visual based; performed with bioassessments
<hr/>		
<b>Quality assurance program elements</b>		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

## Data Analysis and Interpretation

<b>Data analysis tools and methods</b>	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics ( <i>aggregate metrics into an index</i> )
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
<hr/>		
<b>Multimetric thresholds</b>		
transforming metrics into unitless scores		varies according to metric used: RBP 1989 methods. Always try to use 6 metrics for each project, but the metrics chosen vary depending on the project
defining impairment in a multimetric index		varies according to metric used: >81% non impaired, though this could vary slightly depending on the project
<hr/>		
<b>Evaluation of performance characteristics</b>	<input type="checkbox"/>	repeat sampling
<i>Not currently evaluated</i>	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
<hr/>		
<b>Biological data</b>		
Storage		Excel spreadsheets for internal projects; SRBC is currently working on entering data into STORET.
Retrieval and analysis		Excel spreadsheets for internal projects; working on finding a good statistical package that fits needs